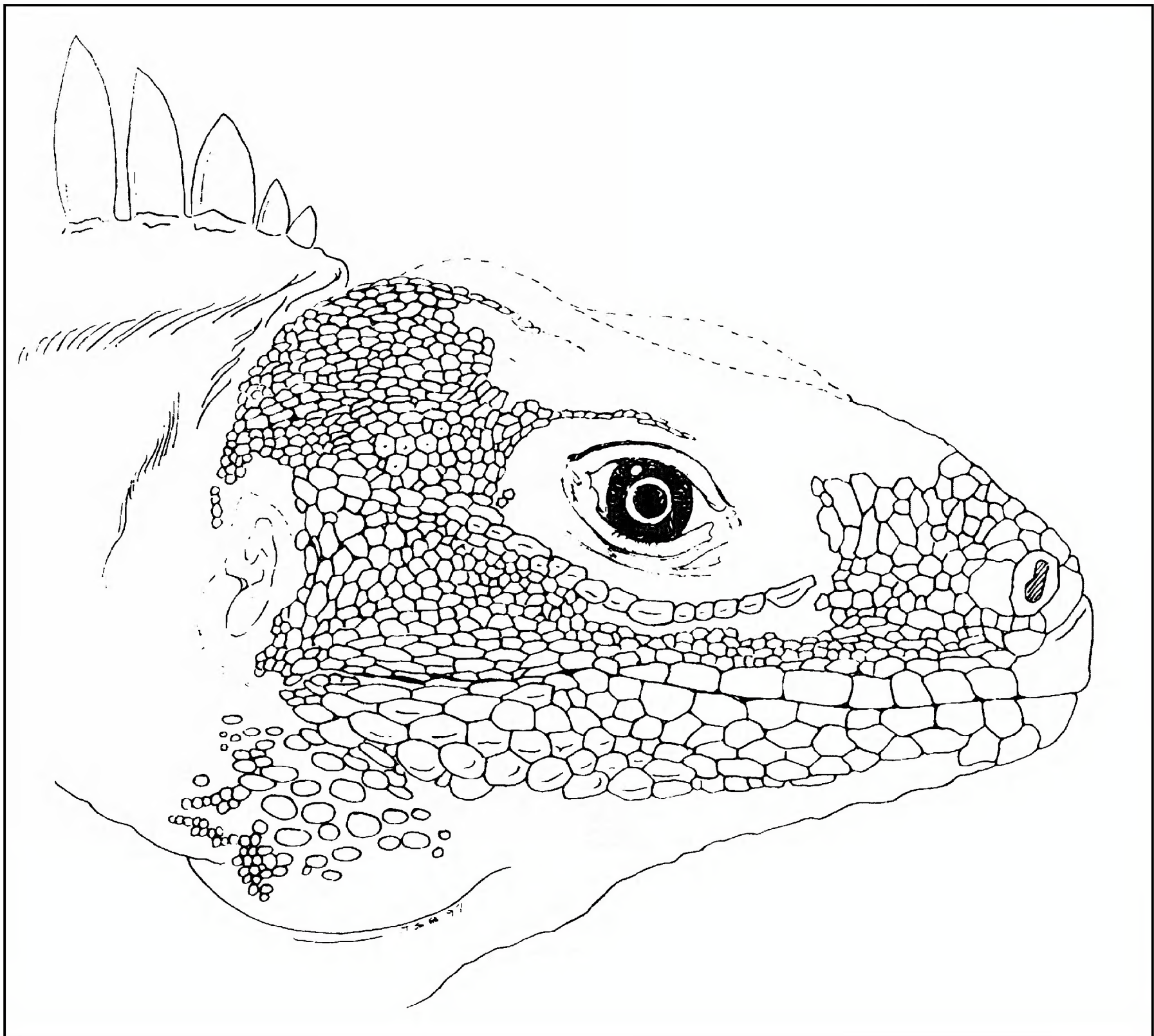

BULLETIN

of the

Chicago Herpetological Society



Volume 33, Number 8
August 1998



BULLETIN OF THE CHICAGO HERPETOLOGICAL SOCIETY

Volume 33, Number 8

August 1998

Notes on Development and Mortality in Giant Toads from Washington Island, Door County, Wisconsin	Charles A. Long	161
Beetle and Toad: An Analysis of the Predator-Prey Relationship of the Predacious Diving Beetle (Coleoptera: Dytiscidae) and Colorado's Endangered Boreal Toad (<i>Bufo boreas boreas</i>)	Gregory P. Horstman	164
Currently Happening Stuff	Gary Kostka	171
HerPET-POURRI	Ellin Beltz	173
The Tympanum	Lori King-Nava; Andrew J. Crawford	176
Herpetology 1998		177
Unofficial Minutes of the CHS Board Meeting, July 17, 1998		178
Advertisements		179

Cover: Head scalation of a female *Cyclura carinata bartschi*. Drawing by John Bendon courtesy of *Iguana Times* and the International Iguana Society.

STAFF

Editor: Michael A. Dloogatch

Copy editor: Jill Horwich

Advertising Manager: Ralph Shepstone

1998 CHS Board of Directors

Steve Spitzer, President

Jack Schoenfelder, Vice-President

Gary Fogel, Treasurer

Jennifer Picciola, Recording Secretary

Lori King-Nava, Corresponding Secretary

Michael A. Dloogatch, Publications Secretary

Gino Martinez, Membership Secretary

Ron Humbert, Sergeant-at-Arms

Karen Bielski, Member-at-Large

John Driscoll, Member-at-Large

Audrey Vanderlinden, Member-at-Large

Jenny Vollman, Member-at-Large

The Chicago Herpetological Society is a nonprofit organization incorporated under the laws of the state of Illinois. Its purposes are education, conservation and the advancement of herpetology. Meetings are announced in this publication, and are normally held at 7:30 P.M., the last Wednesday of each month.

Membership in the CHS includes a subscription to the monthly *Bulletin*. Annual dues are: Individual Membership, \$22.00; Family Membership, \$25.00; Sustaining Membership, \$50.00; Contributing Membership, \$100.00; Institutional Membership, \$38.00. Remittance must be made in U.S. funds. Subscribers outside the U.S. must add \$12.00 for postage. Send membership dues or address changes to: Chicago Herpetological Society, Membership Secretary, 2060 N. Clark Street, Chicago, IL 60614. Publications are sent to U.S. members via third class bulk mail; the post office does not forward such mail, even if a special request is made to forward magazines.

Manuscripts published in the *Bulletin of the Chicago Herpetological Society* are not peer reviewed. Manuscripts should be submitted, if possible, on IBM PC-compatible or Macintosh format diskettes. Alternatively, manuscripts may be submitted in duplicate, typewritten and double spaced. Manuscripts and letters concerning editorial business should be sent to: Chicago Herpetological Society, Publications Secretary, 2060 N. Clark Street, Chicago, IL 60614. **Back issues** are limited but are available from the Publications Secretary for \$2.50 per issue postpaid. **Visit the CHS home page at** <<http://www.Chicagoherp.org>>.

The BULLETIN of the Chicago Herpetological Society (ISSN 0009-3564) is published monthly by the Chicago Herpetological Society. Copyright © 1998.

Notes on Development and Mortality in Giant Toads from Washington Island, Door County, Wisconsin

Charles A. Long

Department of Biology and Museum of Natural History
University of Wisconsin-Stevens Point
Stevens Point, WI 54481

An interesting population of giant toads (*Bufo* sp.) ranges from the Garden Peninsula of Upper Michigan on several isles across Green Bay, possibly occurring at the Ridges Sanctuary on the Door Peninsula (Mueller, 1991), and on South Fox Island (in the Beaver Islands), in eastern Lake Michigan (Long, 1982; 1993). Whether this toad is a microgeographical variant, a localized subspecies, or even a species remains unclear. Unfortunately, until it is recognized by some name, even by the morph name *alani* as proposed by Long (1982), there probably will be little attention given to its study and preservation (Vogt, 1981; Long, 1993; Pentecost and Vogt, 1976; Caspar, 1993; Long and Long, 1976; Long et al., 1987). There are several quite distinctive features of these toads, especially size which shows no overlap between numerous large females and those of any mainland Wisconsin females observed. Pronounced cephalic ridges (postorbital and interorbital ridges resembling the *B. americanus americanus* pattern, but developed much higher and wider [Figure 1]), relatively slimmer body build except for the head and mouth widths, relatively smaller tympanic membrane, much wider dorsal median stripe, less warty hinder parts, less regular reniform parotoid glands, and less colorful spots and stripes are all noteworthy. Possibly different times of breeding have been mentioned (Hatt et al., 1948).

Herein I provide some descriptions of young toads referred to "*alani*" from northern Washington Island, taken near Jackson Harbor, discussing some phases of morphological develop-

ment between emergence of tadpoles (never yet described) and the attainment of giant size. All live *B. "alani"* toads described were collected in July 1997 (at sand dunes, and in beech and maple woods). Comparisons were made with live toads from central Wisconsin (Stevens Point) and eastern Minnesota (Hugo), taken in early August, 1997 (in grassy wetlands).

Results

Some outstanding features of the Washington Island toads are listed in Table 1. The toads generally resembled *B. a. americanus* in pattern, color, and cranial ridge patterns, the aforementioned differences notwithstanding. *B. a. americanus* is the closest race geographically of the *B. americanus* complex, and probably could hybridize with "*alani*." However,

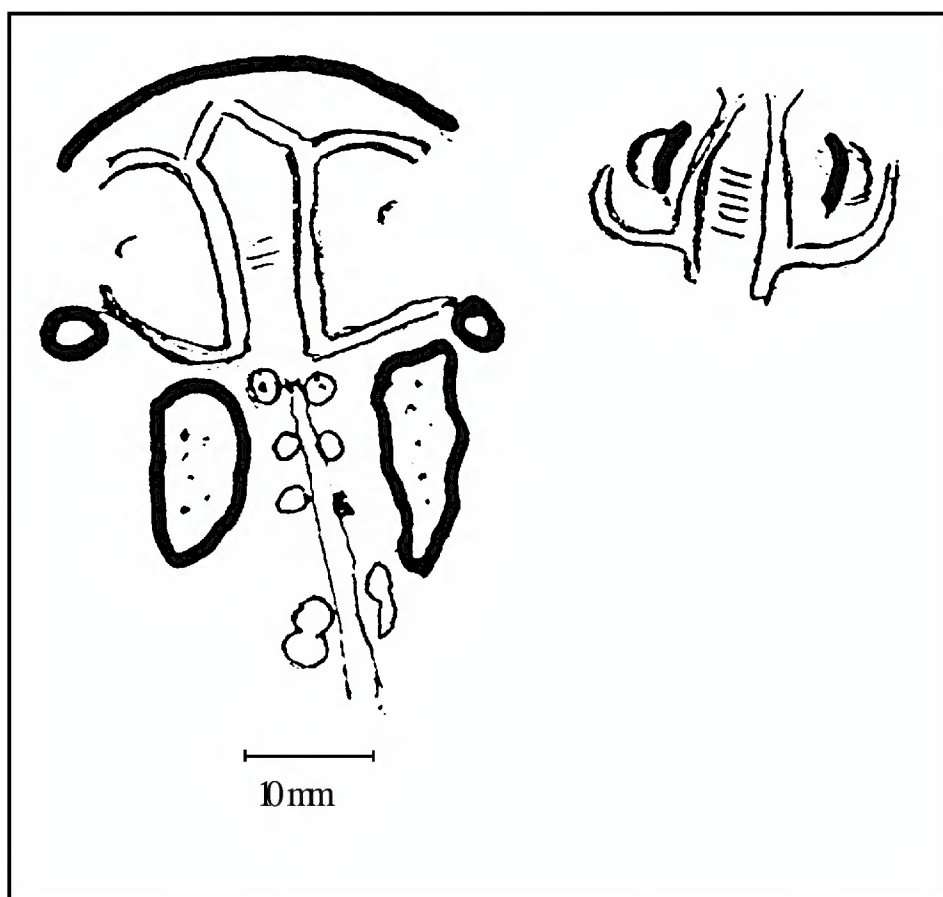


Figure 1. Cephalic ridge patterns of giant toads. These sketches show huge warts, wide median stripe, relatively small tympanum, and anterior extensions of interorbital ridges. There is wrinkled skin between the eyes.

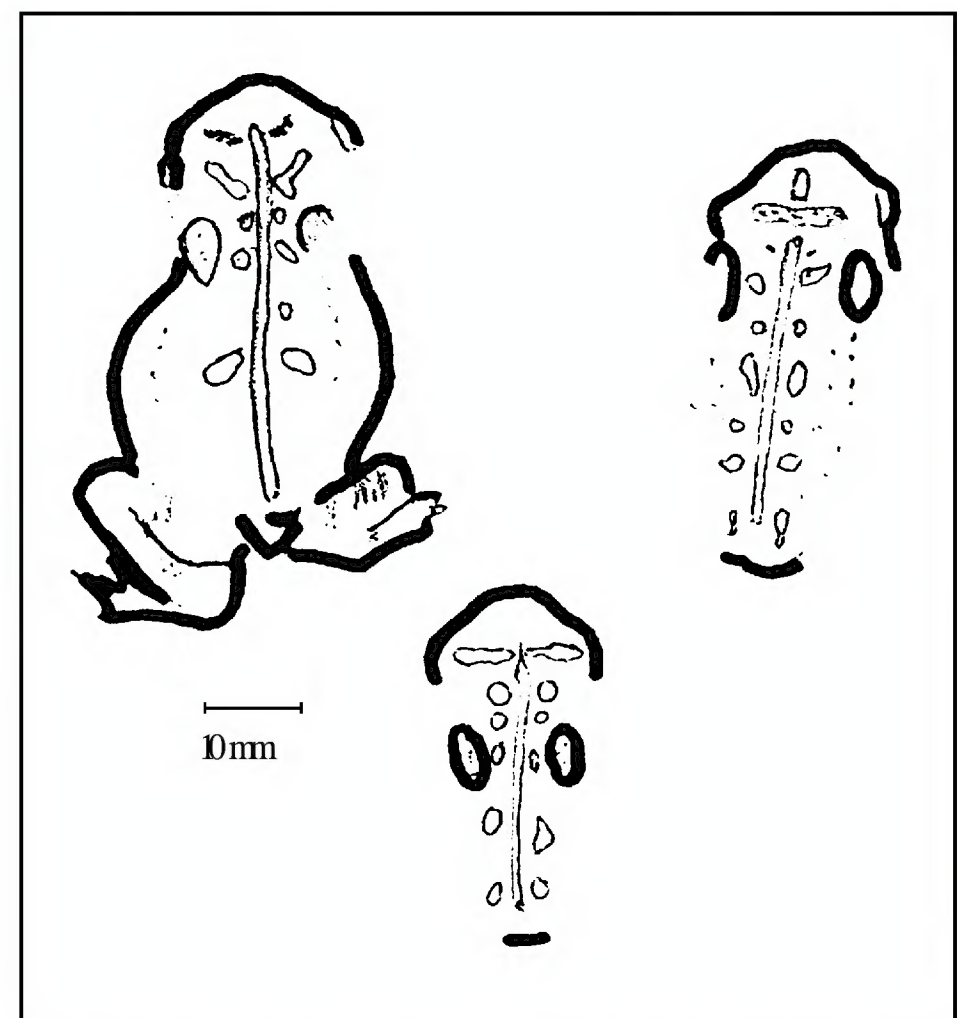


Figure 2. Spot patterns observed on small toads from Washington Island. The "mask" is always brownish gray. Parotoids vary from tan to brown. Spots are chestnut, surrounded with blackish and edged peripherally with a miniscule border of lemon yellow. Median stripes are pale greenish. Tiny red dots are scattered over the upper parts and 6-9 are aligned dorsolaterally on either side. The interaction of median stripe and "mask" is interesting. Anteriorly the small toads are generally brownish tan above (dorsally), the spots marked (not so colorfully as generally seen on the mainland) with black and chestnut-brown, the venters pale greenish gray or white mottled or spotted with gray-black. The hind legs are striped but not conspicuously. In small toads there is no tympanum evident or cephalic ridges. In a newly emerged toad from Washington Island there was a creamy tiny triangle on the forehead, there was no median stripe, and there were no blotches or spots evident on the lichen-green venter.

Table 1. Observations on live specimens and some preserved adults of the toad called “*alani*.” Toads are from Washington Island, one from Rock Island, 1 km north, and from South Fox Island, Beaver Islands. Length is snout-vent (body) length. Median stripe and cranial ridges: present = +; prominent = ++; lacking = -.

Length (mm)	Cranial ridges	Parotoid length (mm)	Tympanum diameter (mm)	Median stripe	Remarks
13 females (89–104) mean 98.5	++	(17.4–21.8) mean 19.1	not measured	++	(Long, 1982) from South Fox Island. No “masks” evident.
female 107	++	19	?	++	No “mask” evident. Venter gray-green, blotched gray.
female 125	++	19	<6	++	No “mask” evident. Venter yellow-green, blotched grayish. Greatest width of median stripe 5.5 mm. Height of cranial ridges 1–2 mm. Skin wrinkled between eyes.
female 112	++	21	5, <5 right	++	No “mask” evident. Venter yellow-green, blotched. Largest warts as large as tympanum.
?male 61	++	15	5	+	Obscure “mask.” Venter yellow-green, gray spots (2–3 mm diameter).
37	+	10 (not discrete)	not evident	+	“Mask” present. Venter gray-green with gray spots.
35	-	9	-	+	“Mask” present. Venter gray-green, blotched.
35	-	9	-	+	“Mask” present. Venter yellow-gray, mottled gray.
30	-	5.5, 5.6 right	-	+	“Mask” present. Venter yellow-gray, gray spots.
24	-	5–6 (not distinct)	-	+	“Mask” present. Venter yellow, tiny gray spots. Median stripe interrupted for “mask.”
13	-	-	-	-	No “mask.” Venter lichen-gray, no spots. Triangle of cream color between the eyes and nostrils.

any giantism in mainland toads would suffer decreased Darwinian fitness (see Long, 1982; 1993). Possibly there is an egg-number advantage in the giant toads (Long, 1982) in their shoreline habitats. Apparently as in the eggs (Long, 1982) the newly emerged toad was not exceptionally large in “*alani*” (Table 1).

Of interest is the pattern of the newly emerged toad (late, 27 July) which is only 13 mm in snout-vent (body) length. It lacked any spots or blotches on its lichen-green venter. There was a triangle of cream color (never seen in *B. a. americanus*) between the eyes and nostrils. Neither “mask” (referring to a pair of spots that cross the forehead broader than long and which nearly meet at the mid-line) nor dorsal median stripe were present. Frog-like in appearance, but showing anlagen of the typical spot (wart) pattern of *B. a. americanus* there also were obscure longitudinal blotchy lines extending on either side. Young toads of *B. a. americanus* often lacked a median stripe, but always, even in adults showed the so-called “mask.”

In all small toads, eyes are black and copper, yellow or brown. Tubercles of yellow or orange were found on the plantar and palmar surfaces of the feet. Small reddish spots are scattered over the upper parts from head to toe and formed a dorsolateral line of 6–9 spots on either side on Washington Island toads and in Stevens Point toads. This dorsolateral line was not evident in the drab Minnesota toads. Ear membranes were not evident in small toads.

In the next size larger (24 mm) on Washington Island the median line was distinct but it was interrupted for the connection of the forehead spots comprising the “mask.” No other specimen observed showed such interruption of the dorsal line (Figure 2).

The largest Washington Island toads were longer, less circular in dorsal outline than mainland toads, and the head ridges were quite prominent. Unlike *B. a. americanus* (see Blair et al., 1968) the prominent postorbital ridges were separate from the huge parotoids. Wrinkles often appeared between the interorbital ridges (Figure 1).

Table 2. Live toads from Hugo, Minnesota (7 August 1997, N = 12, Sex ?), and from Stevens Point, Wisconsin (30 July and 2 August 1997, N = 4, 1 adult, Sex ?). Six tiny toads from Hugo and one from Stevens Point were not measured). Length is snout–vent (body) length. Median stripe: present = +; lacking = -.

	Length (mm)	Parotoid length (mm)	Tympanum diameter (mm)	Median stripe	Remarks
Hugo, Minnesota	60*	13	?	+	Body greenish tone and biscuit-shaped.
	50	12	?	+	Thin, delicate median stripe. Wart spots bright.
	31	8	-	-	Spots bright. No reddish spots.
	21	5–6	-	-	Spots bright. No reddish spots.
	20	5–6	-	-	Drab, no color. No reddish spots.
	20	5–6	-	-	Brownish. No reddish spots.
Stevens Point, Wisconsin	71*	18**	8, 9 right	+	Body biscuit-shaped. Delicate median stripe. Bright spots. Wide yellow margins. “Mask” distinct. Warty posterior.
	25*	6	-	-	Dark brown. No reddish spots. “Mask” present.
	21*	6	-	-	Distinct wart spots. Yellow tubercles on feet. Red dot lines on sides. Color brown-grey. “Mask” present.

* Warty (pimply) hind legs.

** “Mask” extends toward midline across interorbital ridges (which are only 1 mm in height).

The largest Stevens Point toads and Minnesota toads were biscuit-shaped, smaller and more colorful (Table 2). They were more warty posteriorly than were the Island toads. However, the Minnesota toads were not colorful, and showed an unusual pattern in one small toad (lacking a median stripe) having several vertical blotchy lines conjoined ventrally on each side. Half of the 12 toads in Minnesota lacked the median stripe, even including one of the large toads. Always in observed *B. a. americanus* the stripe is a thin, delicate, whitish line when present.

In Island giants there are sharp projections scattered on the hind limbs and even on the forelimbs almost resembling scales or “denticles”, but conspicuous warts are not evident on the rump and thighs posteriorly. The anterior dorsal warts, not surprisingly, are huge (usually one to a spot) in Island giants. The spots or large warts usually were surrounded by black or brown and margined faintly with lemon yellow on Washington Island, and also in Stevens Point. Although large *B. a. americanus* is more colorful than large “*alani*” the smaller toads were generally dark brownish or gray in *B. a. americanus* but

striped and blotched in “*alani*”, showing notable dark chestnut, pale greenish, yellow, orange, gray, reddish and blackish colors.

Long (1982, 1993) mentioned field collectors, cars and raptors as mortality problems for giant toads. Two flying crows were observed in August 1996, one carrying a giant toad, which it dropped in front of me. It probably was a road kill. A garter snake (*Thamnophis sirtalis*) was seen pursuing a small toad in August 1997, and two giants were killed by cars on the road at this time. In August 1996, two were seen killed on the road. Cars near Jackson Harbor, Washington Island, seem to kill giant toads every summer.

Acknowledgments

I thank my family (Alan, Claudine, John, Tyler, and Stephanie) for collecting live toads for this study. Dr. Hobart Smith gave me suggestions. Kim Becken helped prepare the manuscript.

Literature Cited

Blair, W. F. , A. P. Blair, P. Brodkorb, F. Cagle, and G. A. Moore. 1968. Vertebrates of the United States, 2nd ed. New York: McGraw-Hill Book Co.

Caspar, G. S. 1993. Wisconsin herpetological atlas project. Milwaukee Publ. Mus. Museum Publ.

Hatt, R. T., et al. 1948. Island life: A survey of the land vertebrates of the islands of Lake Michigan. Cranbrook Inst. Sci. Bull., No. 27.

Long, C. A. 1982. Rare gigantic toads. . . Works on breeding birds and gigantic toads. Mus. Nat. Hist., Univ. Wisconsin—Stevens Point 18:1-19.

- Long, C. A. 1993. Biogeography of the reptiles and amphibians of the Lake Michigan isles. *Bull. Chicago Herp. Soc.* 28:214-218.
- Long, C. Alan, and C. A. Long. 1976. Some amphibians and reptiles from Washington Island, Lake Michigan. *Jack-Pine Warbler*, 54:54-58.
- Long, C. A., J. E. Long and C. Alan Long. 1987. A listing of known amphibians and reptiles from Washington Island, Lake Michigan, with new records of the milk snake and red-bellied snake. *Jack-Pine Warbler*, 65: 39.
- Mueller, L. 1991. The big one! *Ridges News*. Door County Sanctuary, 17: 6.
- Pentecost, E. D., and R. C. Vogt. 1976. Amphibians and reptiles of the Lake Michigan drainage basin. *Argonne Nat. Lab., Env. Status* 40, 16:1-69.
- Vogt, R. C. 1981. Natural history of amphibians and reptiles in Wisconsin. Milwaukee, WI: Milwaukee Public Museum.

Bull. Chicago Herp. Soc. 33(8):164-170, 1998

Beetle and Toad: An Analysis of the Predator-Prey Relationship of the Predacious Diving Beetle (Coleoptera: Dytiscidae) and Colorado's Endangered Boreal Toad (*Bufo boreas boreas*)

**Gregory P. Horstman
P.O. Box 3224
Winter Park, CO 80482**

Introduction

The dynamics of predator-prey relationships have evolved over millennia. The relationships can be extremely complex, especially those that cross phylogenetic boundaries and involve role reversals. While it may seem selectively advantageous for the majority of predators to reduce, but not eliminate, their prey populations (Formanowicz and Brodie, 1982), some predators may have the ability to completely eliminate local populations of prey (Heyer and Muedeking, 1976). Since prey populations normally outnumber predator populations by several degrees of magnitude, the isolated, "complete" predation scenario, if it indeed exists, should contribute little to the extinction of any taxon of prey. In fact, natural extinctions are extremely rare. Pechmann and Wilbur (1994) could not think of "a single example of a known, natural extinction of any species of any taxa during recent historical times."

However, what if, because of a rare combination of stochastic and anthropogenic events, a prey population has dwindled to the point of "endangered" status? Could the continuation of naturally occurring predation, accompanied by "complete" predation scenarios, tip the scales toward extinction? Such a potentially deleterious predator-prey relationship between an insect predator, the predacious diving beetle (Coleoptera: Dytiscidae), and an amphibian prey, the boreal toad (*Bufo boreas boreas*), currently exists and will be the basis for this study.

The life histories of both the predacious diving beetle and the boreal toad are themselves complex. The boreal toad may be preyed upon in the egg stage, during any one of the many Gosner larval tadpole stages (Gosner, 1960), as a metamorphosed toadlet, or as a juvenile or adult. Metamorphosed toadlets, juveniles, and adults, in turn, are carnivorous predators themselves, feeding heavily on insects and other invertebrates. Ironically, both adult and juvenile boreal toads more than likely prey upon adult dytiscids. Stomach content analy-

ses of adult boreal toads revealed that coleopterans comprised more than 50% of the food items ingested, with as many as 10 families present, although many were unidentifiable (Campbell, 1970; Schonberger, 1945).

The predacious diving beetle, as its name implies, is a voracious predator, especially in the larval instar stages. The number of instars varies among the species, with 3-5 considered common, although numbers for the vast majority remain undetermined. The only benign life forms in this predator's natural history appear to be the egg and pupal stages.

In such a complex, multistage scenario where the predator eventually becomes the prey, an evaluation of each life cycle of the predator as well as each life cycle of the prey is necessary before reaching any substantive conclusions. Is there a specific stage of maximum predator efficiency, and, if so, does it coincide in time and space with a specific stage of maximum prey vulnerability? This paper will be an attempt to determine whether or not this unique combination occurs naturally and to defend or reject the hypothesis that the predacious diving beetle is a significant factor in the decline of the boreal toad and that it may be contributing to the toad's eventual extinction.

The Prey

Within the last two decades, the southern Rocky Mountain population of the boreal toad has mysteriously declined throughout its range, appearing to have been extirpated from northern New Mexico, reduced to only one breeding population in southern Wyoming, and missing from over 85% of its historic habitat in Colorado (Goettl et al., 1997). This reduction of a once common species coincides with an overall global amphibian crisis, and much speculation exists as to the cause(s) of this phenomenon. Anthropogenic factors such as ultraviolet radiation, acid precipitation, global warming, pollution, pesti-

cides, habitat destruction, introduction of non-native species, and overharvesting (Blaustein and Wake, 1995; Vertucci and Corn, 1996) have been implicated in this trend, but definitive cause-and-effect relationships have yet to be established. A current working hypothesis concerning the boreal toad's decline in Colorado (Carey, 1993) involves a sublethal stress/immunosuppression/death by infectious agent pathway.

However, natural amphibian population fluctuation theories (Pechmann and Wilbur, 1994) have not been eliminated, and, in conjunction with this, the effects of natural predators on the boreal toad are currently being examined. Known vertebrate predators on boreal toad tadpoles, juveniles, and adults include birds (Beiswenger, 1981; Olson, 1989), reptiles (Arnold and Wassersug, 1978), and mammals (summarized in Corn, 1993). Invertebrate predators on boreal toad tadpoles in Colorado include larvae of the predacious diving beetle (pers. obs.; Livo, 1997) and, by implication, aquatic larvae of other coleopterans and of odonotans (dragonflies and damselflies).

Boreal toads emerge from their winter hibernacula to breed in the spring, shortly after their breeding pools become ice-free. In Colorado, this event can vary from mid-May to mid-July, strongly dependent upon weather variables and increasing elevation. Boreal toads have been known to breed in a variety of habitats, from tire ruts, beaver ponds, and glacial kettle ponds to large lakes. However, a close inspection of these sites reveals similarities in the actual microhabitats of egg deposition. When given choices in the wild, female boreal toads will generally select shallow water, gently sloping sites with maximum sun exposure that have a mud/silt, vegetation-free substrate. Abandoned or blown-out beaver ponds, which offer all of the above amenities, and which are less likely to subject eggs and tadpoles to desiccation as waters recede, are the sites of choice if available.

Boreal toad breeding sites have been closely monitored in Colorado over the past three seasons (1995–97), and in each of those seasons, in various regions of the state, one alarming phenomenon has been documented time and again. In the span of one week or less, thousands (in one instance an estimated 10,000) of healthy, well-developing tadpoles have disappeared from the breeding pools without a trace (pers. obs.; Goettl, pers. com.; Livo, pers. com.). It has not been uncommon to document the rapid disappearance of 90%+ of the tadpoles in a given pond. The only biotic or abiotic factors that these disappearances share appear to be the time of year (mid-late July to early August) and the developmental stage of the tadpoles (Gosner stages 26–34, approximate).

The boreal toad relies upon high fecundity and large recruitment to perpetuate the species, since mortality through the first year of life can be as high as 99% (Samollow, 1980). A consistent, range-wide elimination of over 90% of its potential recruitment could be a significant factor in the toad's decline. Since no other significant decline in any other life stage of the boreal toad has been documented in the last three years of extensive research, this particular life stage (tadpole, Gosner 26–34) will be considered to be the stage of maximum prey vulnerability for the purposes of this study.

The Predator

The number of species of Dytiscidae that inhabit North America varies among authors, but that number is quite high. Pennak (1953) lists 400+ species from 33 genera, while Ross (1985) lists 475 species from 42 genera. Larson (1987), reporting on the Dytiscidae of Canada, lists 203 species from 29 genera. The exact number and assemblage of dytiscid beetles that inhabit the boreal toad's range in Colorado (generally the montane and subalpine zones above 8000 ft) is unknown, but, because of similarities in habitat and weather regimes, Colorado's species composition may mirror Canada's.

Dytiscidae occupy a wide range of aquatic microhabitats, but they are normally found in shallow, lentic water, usually not far from the water's edge. According to Pennak (1953), the "presence of a clean substrate and aquatic vegetation seems to be almost indispensable," with few species occurring on muddy bottoms. Larger species, with generally longer larval development, appear to be restricted to larger, more permanent water bodies (Larson, 1987), but large instars have been observed in ephemeral ponds in Colorado (pers. obs.; Livo, pers. com.). As many as 13 species have been recorded from individual pools (Nilsson and Svensson, 1995), and the ephemeral nature of some of these pools is no barrier to the Dytiscidae. Estivating adults have been collected in the root systems of vegetation associated with dry ponds, and those same adults survived more than five months without food or water under laboratory conditions (Garcia and Hagen, 1987).

Considerable life history variations occur within this large family, but most species of Dytiscidae appear to produce only one brood each year and overwinter as adults, although some survive this dormancy as larvae (*Ilybius*) or eggs (*Agabus*) (Larson, 1987). Nevertheless, all late larval instars, dictated by the constraints of higher latitudes and elevations, are of short duration and rapid growth, and pupate by mid-spring to early summer. The larvae of *D. circumcinctus*, a known tadpole predator, are first found in late June and develop throughout July in NE Sweden (Johansson and Nilsson, 1992).

Dytiscidae can range from 1 to 40 mm in length as adults, and as a group are considered exclusively carnivorous, with some having scavenger tendencies. However, adult predation is usually considered less severe than larval predation. Larson (1987) noted that the adults did not "appear particularly adept at prey capture," and both Pennak (1953) and Young (1967) commented on the adults' propensities to fly from one aquatic habitat to another, often being found miles from the nearest water. Dispersal and reproduction are of primary concern to adult dytiscids, and their direct role as a consequential predator on boreal toad tadpoles can be dismissed.

Larvae, on the other hand, remain in one habitat and feed heavily there. Late larval instars of the larger species, considered notoriously voracious, often attack and kill prey much larger than themselves, including fish, salamander larvae, and tadpoles. Large sickle-shaped mandibles, designed for piercing and sucking, are used to capture prey. Digestive and paralyzing enzymes are injected into the prey and then with-

drawn, along with the prey's body fluids, through the mandibles. Generally, the mouth itself remains closed during feeding, although some species can ingest particulate material.

The major portion of food harvesting appears to occur in the larval stages, and prey selection is as dependent on size as availability (Nilsson, 1986; Le Louarn and Cloarec, 1997). The width of the larval mandibles restricts prey dimensions, and smaller larvae (5–11.5 mm.) can only unsuccessfully attack larger tadpoles in the 20 mm range (Young, 1967; pers. obs.).

Nilsson and Soderstrom (1988) determined that at high prey densities, larvae of the larger species consumed significantly more prey than those of smaller species. Intraspecifically, the relative biomass consumed during three successive instars of a *Dytiscus* larva can be 1:3:20, with the relative duration of feeding periods 2:2:5 (Johansson and Nilsson, 1992). The final instar of the larger Dytiscidae can reach 50 mm in length, and at this size a boreal toad tadpole at Gosner stage 26–34 (approximately 25–30 mm) can be easily dispatched. The final instar of the larger Dytiscidae, therefore, is likely the only life stage of the predacious diving beetle that can significantly affect boreal toad populations, and for only a brief period of time at that. For the purposes of this study, the last instar of the largest predacious diving beetle larvae will be considered this predator's stage of maximum predator efficiency.

Pathways to Survival

If predation scenarios that compromise the prey's existence do exist in natural predacious diving beetle/boreal toad interactions, one might surmise that boreal toad tadpoles have evolved with few, if any, predator avoidance or antipredator mechanisms. Or, it may be possible that the tadpoles' predator avoidance and/or antipredator mechanisms, while effective against certain predators, have no effect on the dytiscid larvae. If, as suggested by Brodie et al. (1991), the evolution of either mechanism reduces the selective pressures on the other, might not a weakness in one be exploited by a predator that dominates in the other? An evaluation of the predator survival mechanisms of boreal toad tadpoles is next in order.

Predator Avoidance Mechanisms

Predator avoidance by boreal toad tadpoles would include both spatial and temporal avoidance. Adult *D. alaskanus* have been shown to be strongly nocturnal, with 95% of individuals in one study (Aiken, 1986) trapped between 2200 h and 0600 h, and in the top 5 cm of the water column. Boreal toad tadpoles are very active diurnally, but there is little information on nocturnal behavior. If the diel activity pattern of late instar dytiscids (no information available) mirrors that of the adults, it could place a highly active predator in the midst of a large, inactive prey source.

However, Beiswenger (1977) demonstrated that American toad (*Bufo americanus*) tadpoles undergo a diel pattern of distribution and activity that would safeguard most from nocturnal insect predation. During the night and early morning, these tadpoles were widely dispersed (50–100 cm between

individuals) and inactive, having sought and located thermal refuges in all but the shallowest parts of the ponds. Although some fed occasionally, most remained motionless on the bottom. Likewise, larval tiger salamanders (*Ambystoma tigrinum*) have been shown to leave their warm, shallow-water foraging stations at night when adult Dytiscidae invaded those areas to feed (Holomuzki, 1986).

Bendell and McNicol (1987) found that several groups of predatory insects, including Dytiscidae, were typically absent from lakes containing fish. Boreal toads successfully breed in ponds and lakes in Colorado that are occupied by brook trout (*Salvelinus fontinalis*) as well as those that are devoid of them. Contrary to some persisting sources that claim that trout eat toad eggs and tadpoles, current research (Goettl, pers. com.; pers. obs.) with brook trout and boreal toad tadpoles strongly suggests otherwise. Boreal toad tadpoles have disappeared from breeding sites with or without fish, thus eliminating any spatial correlation that might include fish/dytiscids/tadpoles.

Both the larval instars of Dytiscidae and all stages of larval boreal toads are spatially extant in the shallows of lentic waters. Here, invertebrate predators that utilize piercing/sucking or chewing mouthparts can trigger the release of a chemical alarm pheromone ("Shreckstoff") from a damaged *Bufo* tadpole's skin, signalling conspecifics to flee (Hews and Blaustein, 1985). Hews (1988) found such avoidance responses in *B. boreas* tadpoles triggered by giant waterbug (*Lethocerus americanus*) and dragonfly naiad (*Aeshna umbrosa*) predation. This not only increased the survivorship of the conspecifics, but also decreased the predatory efficiency of the hunting larvae. Within one minute after applying crushed *Bufo americanus* extract to *B. americanus* tadpoles, Petranks (1989) found that 85% of the tadpoles had swum rapidly away from the experimental plots, some to distances of a meter or more. This avoidance response dissipated after 4–5 minutes, suggesting a balance between the strategic fitness strategies of predator avoidance and food intake.

Antipredator Mechanisms

While "Shreckstoff" can elicit a predator avoidance response that benefits conspecifics, it may also be an antipredator device that benefits the individual being attacked. The damage-released alarm pheromone is not a deterrent to insect predators, but has actually been shown to be an attractant. This may increase the prey's probability of escape by attracting other predators that interfere with the original attacker (Mathis et al., 1995).

Aposematic coloration, conspicuousness, and lack of explosive escape response characterize most large masses of boreal toad tadpoles during their development. Although these may be antipredator mechanisms that are effective against visual predators (Hews and Blaustein, 1985), they are ineffective against certain invertebrate predators that do not utilize visual cues in detecting their prey. *Dytiscus* larvae do not appear to use visual cues, instead reacting first to tactile cues (water movement) and secondarily to chemical cues. The beetle larvae will orient towards and approach a moving cue, but a natural prey's chemical cue seems imperative to elicit the full

attack response (Formanowicz, 1987). Data from this same study indicated that the larger, late instar stages also had a greater reactive distance to these tadpole cues, resulting in a greater magnitude of prey mortality.

Caldwell et al. (1980) suggested that tadpoles may have an immobility response to attack by an aquatic predator, resulting in a reduction of water currents and lower detection. The presence of a dytiscid predator significantly lowered the movements of *Bufo calamitas* tadpoles in an experiment by Tejedo (1993). Newly metamorphosed *Bufo* toadlets became immediately immobile after being grasped by dytiscid larvae, resulting in a reduced intensity of the predatory attack, and often the inducement of a seizure and subsequent release without injury (Brodie et al., 1978). The immobility responses of *B. boreas* tadpoles after short spurts of flight following disturbance have been documented in the field in Colorado (pers. obs.; Livo, pers. com.).

Eggs (Licht, 1968; Kwet, 1996) and newly-hatched larvae (Brodie and Formanowicz, 1987) of bufonids appear to be unpalatable to invertebrate insect predators, including dytiscids. However, Peterson and Blaustein (1992) found no evidence to support the claim that newly hatched or metamorphosing tadpoles were less palatable than intermediate stage tadpoles to dytiscid predation, suggesting instead that behavioral differences and selection of microhabitat sites reduced predation on these stages. Newly hatched tadpoles cling to the egg mass, remaining mostly immobile, for several days after hatching while their tail musculature develops, while new metamorphs occupy the water/land interface, removing them from the range of foraging beetle larvae.

The unpalatability of larval bufonids to aquatic insect predators increases as the granular glands in the skin increase in size and toxicity during development (Brodie et al., 1978). Pre-metamorphic stages of *B. americanus* that were offered to *Dytiscus verticalis* larvae were fully palatable, while post-metamorphic individuals were generally rejected as food, indicating the presence of a threshold amount of noxious material that will be accepted by dytiscid larvae (Formanowicz and Brodie, 1982). *Dytiscus verticalis* larvae are also capable of quickly learning to avoid unpalatable prey (Hileman et al., 1995), and the pressure brought by them on bufonid populations in a natural situation is probably relative to the presence and/or abundance of other, more palatable prey species (Formanowicz and Brodie, 1982; Peterson and Blaustein, 1991). However, although data from a few historic sites have indicated otherwise, none of the currently known 50+ boreal toad breeding sites in Colorado are utilized by other high elevation, native amphibians for breeding, although striped chorus frogs (*Pseudacris triseriata*) and tiger salamanders occupy the same general ranges and can often be found short distances away.

Predator/prey Interaction

Numerous laboratory experiments have documented the annihilation of 100% of the tadpole prey offered to large dytiscid predators (most recently Livo, 1997). While these figures are certainly dramatic, similar survivorship patterns are unlikely to occur in nature. Young (1967), in an attempt to

understand predation under natural conditions, showed that large dytiscid larvae (27–33 mm) killed 100% of the *Bufo americanus* tadpoles (17–20.5 mm) offered to them in the laboratory, while medium size larvae (17–23 mm) killed 75%, and small size larvae (5–11.5 mm) could kill none. However, in the 140 × 125 ft natural vernal pond where Young obtained his predator and prey samples, a systematic sampling showed that 70% of the dytiscid larvae were between 14.3 and 14.7 mm in length. Young concluded that natural survivorship of tadpoles in the vernal pond probably corresponded more closely to a combined survivorship curve of his laboratory experiments rather than the curve of the large dytiscid larvae alone. Even so, he reached that conclusion without factoring in the escape and refugia components available to tadpole prey in natural settings.

Beetle larvae were always observed at lower densities than tadpoles in natural ponds studied by Tejedo (1993). Caldwell et al. (1980) discovered a low, constant level of predacious dragonfly nymphs (*Anax junius*) throughout June and July in a natural, vernal pond that also included anuran larvae. They therefore concluded that this predator, probably because of habitat differences and rapid tadpole growth, “did not regulate the density of the tadpole population.” Even Heyer and Muedeking (1976), the authors who proposed the “complete” insect predator/tadpole prey scenario, stated that they would not expect regular elimination in nature, but that “under usual conditions,” the predator would “reduce—not eliminate—tadpole populations.” Only when temporary ponds dried up did they suggest that a “complete” predation scenario might occur.

A somewhat contradictory correlation between pond size, predator density, and tadpole survival was established in two other experiments (Roth and Jackson, 1987; Pearman, 1995). In both instances, an increasing pond size led to a greater incidence of predacious diving beetle larvae coupled with a greater mortality rate for tadpoles. However, the largest of the artificially designed pools in either of the two experiments was less than 3 m², and, while a greater pond size in nature may very well attract more dytiscids, the tadpole prey would have the benefit of increased refugia and a greater chance of escape, neither of which was provided in the experiments. Only one of 22 monitored boreal toad breeding sites in NW Colorado (a rainwater-filled tire rut of approximately 10 m²) remotely approaches these “large” experimental pools, and it dried up before the tadpoles could metamorphose. No dytiscids were observed during this period.

Acknowledging the overt simplicity of his and other similar tadpole/dytiscid larvae experiments, where tadpoles had little chance of escape, Formanowicz (1986) commented that, in a natural predator/prey situation, the probability that a predator would have multiple opportunities to capture an individual tadpole was extremely low. Formanowicz then more realistically examined the capture efficiency of the predator during the first attack, and found that tadpole vulnerability decreased with increasing tadpole size, and increased with increasing predator size. The risk of predation of *B. boreas* tadpoles is directly related to locomotor abilities, with average swimming

velocity, positively correlated to tail length, increasing throughout the pre-metamorphic stages (Huey, 1980). With the larger prey package comes increased pursuit time, longer handling time, and a more elusive prey. Several studies have examined the size-dependent vulnerabilities of tadpoles to dytiscid predators (Brodie and Formanowicz, 1983; Formanowicz, 1986; Tejedo, 1993), with each reaching similar conclusions. Although the beetle larvae will attack a large size range of tadpoles, their preference for larger tadpoles increased as their body size increased. This factor, among others, led Peckarsky (1982) to conclude that insect predators might have more of an influence on prey community structure than on the total annihilation of that community, and that a multitude of conditions must exist that stabilize the link between aquatic insect predators and their prey.

Optimal foraging theory is based on the premise that natural selection will favor a behavioral response that maximizes the net rate of food intake. It therefore predicts that as the probability of prey capture increases (increasing prey density), the feeding time on individual prey items will decrease, leading to a partial consumption of individual prey but an overall increase in food intake (Sih, 1980). Formanowicz (1984), in dytiscid/tadpole experiments that supported this hypothesis, suggested that at high prey densities it was more energetically cost efficient for a sucking predator to remove only the most easily extracted and most highly nutritious food before moving on to the next prey item.

Beetle larvae, by virtue of their piercing/sucking feeding modes, are generally considered partial prey consumers to begin with. Kruse (1983) observed that dytiscid larvae often abandoned partially digested *B. americanus* tadpoles and captured, or attempted to capture, other tadpoles as they swam by. His experiments also demonstrated that larvae fed 20 tadpoles were significantly more "wasteful" than those fed only five tadpoles. Young (1967) noted that tadpole prey were easily recognized as the victims of dytiscid predators "by their shriveled-up appearance resulting from traumatic loss of body contents."

Conclusion

Although species-specific (dytiscid/boreal toad) informational gaps do exist, there is little doubt that the late instar stages of Dytiscidae correspond in time with the mysterious disappearance of boreal toad tadpoles in Colorado. There is little doubt that both predator and prey spatially occupy the same warm water shallows when both reside in the same pond. Likewise, there is little doubt that dytiscid larvae do successfully prey upon boreal toad tadpoles in Colorado, and may impact tadpole density at select locations. However, other ecological factors must be considered before reaching a "significant" conclusion.

As presented, *Bufo* tadpoles in general, and boreal toad tadpoles in particular, have evolved with a number of predator avoidance and antipredator mechanisms that compensate them against most aquatic insect predation. The small number of large dytiscid predators that have been observed in natural settings does not appear able to upset the natural predator/prey balance. The tiny, ephemeral pools with the dytiscid-preferred vegetation that may lead to "complete" predation scenarios do exist, but at less than 10% of the total number of boreal toad breeding sites in Colorado.

Optimal foraging theory may well be the key to resolving this ecological interaction and its consequences. The carcasses of dead boreal toad tadpoles in Colorado breeding pools are easily recognizable on the substrate at least one week after dying (pers. obs.). Recall that the mysterious disappearances of thousands of boreal toad tadpoles in Colorado have occurred "without a trace" and within the span of one week. It would be impossible for dytiscid larvae to be the agents of such mass destruction without leaving hundreds, if not thousands, of black tadpole carcasses plainly visible on the substrate of the breeding ponds.

The results of this study do not support the hypothesis that predacious diving beetle larvae are significant predators of boreal toad tadpoles. Therefore, the predacious diving beetle should not be considered an agent that is significantly contributing to the "endangered" decline of the boreal toad across its range in Colorado.

Literature Cited

- Aiken, R. B. 1986. Diel activity of a boreal water beetle (*Dytiscus alaskanus*: Coleoptera; Dytiscidae) in the laboratory and field. *Freshwater Biology* 16:155-159.
- Arnold, S. J., and R. J. Wassersug. 1978. Differential predation on metamorphic anurans by garter snakes (*Thamnophis*): Social behavior as a possible defense. *Ecology* 59(5):1014-1022.
- Beiswenger, R. E. 1977. Diel patterns of aggregative behavior in tadpoles of *Bufo americanus*, in relation to light and temperature. *Ecology* 58:98-108.
- . 1981. Predation by gray jays on aggregating tadpoles of the boreal toad (*Bufo boreas*). *Copeia* (2):459-460.
- Bendell, B. E., and D. K. McNicol. 1987. Fish predation, lake acidity and the composition of aquatic insect assemblages. *Hydrobiologia* 150:193-202.
- Blaustein, A. R., and D. B. Wake. 1995. The puzzle of declining amphibian populations. *Scientific American*, April 1995:52-57.
- Brodie, E. D., Jr., and D. R. Formanowicz, Jr. 1983. Prey size preference of predators: Differential vulnerability of larval anurans. *Herpetologica* 39(1):67-75.

- Brodie, E. D., Jr., and D. R. Formanowicz, Jr. 1987. Antipredator mechanisms of larval anurans: Protection of palatable individuals. *Herpetologica* 43(3):369-373.
- Brodie, E. D., Jr., D. R. Formanowicz, Jr., and E. D. Brodie, III. 1978. The development of noxiousness of *Bufo americanus* tadpoles to aquatic insect predators. *Herpetologica* 34(3):302-306.
- Brodie, E. D., Jr., D. R. Formanowicz, Jr., and E. D. Brodie, III. 1991. Predator avoidance and antipredator mechanisms: Distinct pathways to survival. *Ethology, Ecology & Evolution* 3:73-77.
- Caldwell, J. P., J. H. Thorp and T. O. Jervey. 1980. Predator-prey relationships among larval dragonflies, salamanders, and frogs. *Oecologia* 46:285-289.
- Campbell, J. B. 1970. Life history of *Bufo boreas boreas* in the Colorado front range. Unpub. Ph.D. thesis. University of Colorado, Boulder. 110 pp.
- Carey, C. 1993. Hypothesis concerning the causes of the disappearance of boreal toads from the mountains of Colorado. *Conservation Biology* 7(2):355-362.
- Corn, P. S. 1993. *Bufo boreas* (boreal toad). Predation. *Herpetological Review* 24(2):57.
- Formanowicz, D. R., Jr. 1984. Foraging tactics of an aquatic insect: Partial consumption of prey. *Animal Behavior* 32:774-781.
- . 1986. Anuran tadpole/aquatic insect predator-prey interactions: Tadpole size and predator capture success. *Herpetologica* 42(3):367-373.
- . 1987. Foraging tactics of *Dytiscus verticalis* larvae (Coleoptera: Dytiscidae): Prey detection, reactive distance and predator size. *Journal of the Kansas Entomological Society* 60(1):92-99.
- Formanowicz, D. R. Jr., and E. D. Brodie, Jr. 1982. Relative palatabilities of members of a larval amphibian community. *Copeia* (1):91-97.
- Garcia, R., and K. S. Hagen. 1987. Summer dormancy in adult *Agabus disintegratus* (Crotch) (Coleoptera: Dytiscidae) in dried ponds in California. *Annals of the Entomological Society of America* 80:267-271.
- Goettl, J. P., editor, and the Boreal Toad Recovery Team. 1997. Boreal Toad Recovery Plan. Colorado Division of Wildlife, Denver. 56pp. + Appendix.
- Gosner, K. L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* 16:183-190.
- Hews, D. K. 1988. Alarm response in larval western toads, *Bufo boreas*: Release of larval chemicals by a natural predator and its effect on predator capture efficiency. *Animal Behavior* 36:125-133.
- Hews, D. K., and A. R. Blaustein. 1985. An investigation of the alarm response in *Bufo boreas* and *Rana cascadae* tadpoles. *Behavioral and Neural Biology* 43:47-57.
- Heyer, W. R., and M. H. Muedeking. 1976. Notes on tadpoles as prey for naiads and turtles. *Journal of the Washington Academy of Science* 66:235-239.
- Hileman, K. S., E. D. Brodie, Jr., and D. R. Formanowicz, Jr. 1995. Avoidance of unpalatable prey by predaceous diving beetle larvae: The role of hunger level and experience (Coleoptera: Dytiscidae). *Journal of Insect Behavior* 8(2):241-249.
- Holomuzki, J. R. 1986. Predator avoidance and diel patterns of microhabitat use by larval tiger salamanders. *Ecology* 67:737-748.
- Huey, R. B. 1980. Sprint velocity of tadpoles (*Bufo boreas*) through metamorphosis. *Copeia* (3):537-540.
- Johansson, A., and A. N. Nilsson. 1992. *Dytiscus latissimus* and *D. circumcinctus* (Coleoptera, Dytiscidae) larvae as predators on three case-making caddis larvae. *Hydrobiologia* 248:201-213.
- Kruse, K. C. 1983. Optimal foraging by predaceous diving beetle larvae on toad tadpoles. *Oecologia* 58:383- 388.
- Kwet, A. 1996. Zu den natuerlichen feinden des laichs von froschlurchen. *Salamandra* 32(1):31-44.
- Larson, D. J. 1987. Aquatic Coleoptera of peatlands and marshes in Canada. Pp. 99-132. In: D. M. Rosenberg and H. V. Danks, editors. Aquatic insects of peatlands and marshes in Canada. The Entomological Society of Canada, Ottawa. 174 pp.
- Le Louarn, H., and A. Cloarec. 1997. Insect predation on pike fly. *Journal of Fish Biology* 50:366-370.
- Licht, L. E. 1968. Unpalatability and toxicity of toad eggs. *Herpetologica* 24(2):93-98.
- Livo, L. J. 1997. Slide presentation. The Boreal Toad Recovery Team. Denver, Colorado. 22 October 1997.

- Mathis, A., D. P. Chivers, and R. J. F. Smith. 1995. Chemical alarm signals: Predator deterrents or predator attractants? *The American Naturalist* 145(6):994-1005.
- Nilsson, A. N. 1986. Community structure in the Dytiscidae (Coleoptera) of a northern Swedish seasonal pond. *Annales Zoologici Fennici* 23:39-47.
- Nilsson, A. N., and O. Soderstrom. 1988. Larval consumption rates, interspecific predation, and local guild composition of egg-overwintering *Agabus* (Coleoptera, Dytiscidae) species in vernal ponds. *Oecologia* 76:131-137.
- Nilsson, A. N., and B. W. Svensson. 1995. Assemblages of dytiscid predators and culicid prey in relation to environmental factors in natural and clear-cut boreal swamp forest pools. *Hydrobiologia* 308:183-196.
- Olson, D. H. 1989. Predation on breeding western toads (*Bufo boreas*). *Copeia* (2):391-397.
- Pearman, P. B. 1995. Effects of pond size and consequent predator density on two species of tadpoles. *Oecologia* 102:1-8.
- Pechmann, J. H. K., and H. M. Wilbur. 1994. Putting declining amphibian populations in perspective: natural fluctuations and human impacts. *Herpetologica* 50(1):65-84.
- Peckarsky, B. L. 1982. Aquatic insect predator-prey relations. *Bioscience* 32(4):261-266.
- Pennak, R. W. 1953. Fresh-water invertebrates of the United States. The Ronald Press Company, New York. ix + 769pp.
- Peterson, J. A., and A. R. Blaustein. 1991. Unpalatability in anuran larvae as a defense against natural salamander predators. *Ethology, Ecology & Evolution* 3:63-72.
- Peterson, J. A., and A. R. Blaustein. 1992. Relative palatabilities of anuran larvae to natural aquatic insect predators. *Copeia* (2):577-584.
- Petranka, J. W. 1989. Response of toad tadpoles to conflicting chemical stimuli: Predator avoidance versus "optimal" foraging. *Herpetologica* 45(3):283-292.
- Ross, H. A., Jr. 1985. American insects. A handbook of the insects of America north of Mexico. Van Nostrand Reinhold, New York. xiii + 850pp.
- Roth, A. H., and J. F. Jackson. 1987. The effect of pool size on recruitment of predatory insects and on mortality in a larval anuran. *Herpetologica* 43(2):224-232.
- Samollow, P. B. 1980. Selective mortality and reproduction in a natural population of *Bufo boreas*. *Evolution* 34:18-39.
- Schonberger, C. F. 1945. Food of some amphibians and reptiles of Oregon and Washington. *Copeia* 1945(2):120-121.
- Sih, A. 1980. Optimal foraging: Partial consumption of prey. *The American Naturalist* 116:281-290.
- Tejedo, M. 1993. Size-dependent vulnerability and behavioral responses of tadpoles of two anuran species to beetle larvae predators. *Herpetologica* 49(3):287-294.
- Vertucci, F. A., and P. S. Corn. 1996. Evaluation of episodic acidification and amphibian declines in the Rocky Mountains. *Ecological Applications* 6(2):449-457.
- Young, A. M. 1967. Predation in the larvae of *Dysticus marginalis* Linneaus (Coleoptera: Dytiscidae). *The Pan-Pacific Entomologist* 43(2):113-117.

Currently Happening Stuff

reported by Gary Kostka

Serpent Safari . . .

No matter what your particular area of interest in herpetology, odds are that you've heard of Dr. John Rossi, a veterinarian from Jacksonville, Florida, and author of the two-volume set, *Snakes of the United States and Canada:*

Keeping Them Healthy in Captivity. The CHS was indeed privileged to have Dr. Rossi as the featured speaker at the May 27 general meeting. His presentation covered his extensive field trips throughout the U.S. in search of the many and varied species of snakes included in the aforementioned *Snakes of the U.S. and Canada*. The program included slides depicting over 60 different types of snakes accompanied by Dr. Rossi's comments on the natural history and captive husbandry aspects of each.

Needless to say, every ophidiophile in attendance must have felt as if they'd died and gone to heaven as slide after splendid slide of serpents both common and rare graced the screen. But snake fanciers weren't the only ones with something to gain from Dr. Rossi's presentation. His descriptions of the innovative husbandry techniques that he has developed most certainly provided every herp keeper in the crowd with some fresh insights as to how they might better take care of their own animals, no matter what species they might be.

Dr. Rossi explained that he was inspired to write a book on the captive care of snakes because of the numerous snakes being brought to him for veterinary care that were suffering simply because they weren't being kept properly. What began as a modest project to pen a book on the captive maintenance of the snakes of Florida eventually snowballed into the rather more formidable task of describing the natural history and captive care of the snakes of the eastern U.S. and Canada. At his publisher's urging, Dr. Rossi wrote a follow-up book covering the snakes of the western region of the two countries. The resultant two-volume set is unique in its coverage of the majority of the North American snake species from a captive maintenance standpoint.

Establishing the husbandry techniques necessary to keep many of these snakes alive, much less breeding in captivity required Dr. Rossi and his wife Roxanne to maintain a collection of some 250 animals representing 90 species in their home. "Wall to wall snakes" was how Dr. Rossi described the decor of his North Florida farmhouse as he harkened back to the period during which he and his wife were working on the project.

Amassing the substantial collection of snakes on which his research was based was no easy task, requiring Dr. Rossi and his wife to traverse the country, seeking specimens in some of the more exotic and storied herp habitats across the U.S. Their travels and the serpents they encountered formed the

framework for Dr. Rossi's fascinating presentation.

I had the opportunity to chat with Dr. Rossi following the meeting about some of the topics he'd covered in his presentation. In the course of our conversation, he mentioned that he was con-

templating the construction of a flowing stream in his back yard so that he might better be able to maintain and breed his Brazos water snakes, an endangered species with which he is currently working. Now that's what I call dedicated enthusiasm!

Thanks Dr. Rossi for sharing your enthusiasm with us.

Excuse me, I'm looking for the St. Louis Zoo . . .

In the early morning hours of Saturday, June 14, a busload of intrepid CHS members, families and friends began a westward journey that would ultimately lead them to the Herpetarium at the St. Louis Zoo.

The trip to the city limits of St. Louis was pleasantly uneventful. The doldrums induced by the five-and-a-half-hour trip through the agrarian landscape of central Illinois were assuaged via the film classics "Mouse Hunt" and "Starship Troopers," which were shown on the motorcoach's (state-of-the-art?) six monitor video array. Little did we suspect as we caught our first glimpse of the Gateway Arch shortly before crossing the mighty Mississipp' that our well laid travel plans were about to go awry.

After crossing the river, we proceeded onward toward the herpetological promised land, each of us made giddy by our thoughts of the wonders which lay just ahead. But the sounds of happily expectant herp enthusiasts were soon replaced by quizzical mutterings as our zoo-bound progress was halted when our driver prematurely exited the expressway. We sat in stunned silence as he maneuvered the bus through a residential neighborhood and proceeded to re-enter the expressway. However, we were now heading eastward, back toward the Land of Lincoln whence we had come.

The situation became curiouser and curiouser as our change of course carried us back past the Arch in a northerly direction along Ol' Man River's western shore. Now, anyone who's ever been to the St. Louis Zoo (and a good number of those on board qualified) and has half a head for directions (once again, a good number qualified) knows that the Zoo is located directly west of the downtown area. It was becoming uncomfortably apparent as the Arch disappeared behind us to the south that if we were to continue unchecked on our present course, we stood a better chance of reaching the headwaters of the Mississippi than we did of reaching the St. Louis Zoo.

Fortunately, the driver also seemed to sense this and so en-

deavored to take corrective action. Alas, it was too late as we were already well off the beaten path. To make a long story short, we spent the next 45 minutes frantically searching for the zoo. We traveled through portions of St. Louis where tour buses are seldom seen, judging from the curious looks directed our way. Anyone familiar with the hilarious scene from the film "Vacation," in which the hapless Clark Griswold (Chevy Chase) and family find themselves hopelessly lost in the seamiest part of St. Louis, and are forced to rely on less-than-friendly locals for directional assistance will have an appreciation for our predicament. After a number of stops to inquire as to the whereabouts of the zoo, our driver was finally able to attain his goal at 12:30 P.M.

We rendezvoused at the Herpetarium at 1:00 and broke up into three groups to begin our eagerly anticipated "behind the scenes" tour of the facility. My group's tour was led by Jeff Ettling, Curator of Reptiles at the zoo and the man responsible for arranging our visit. We spent nearly two hours with Jeff and had a marvelous time as we leisurely meandered through the basement and backroom areas of the Herpetarium, admiring hundreds of off exhibit herps and learning about the day-to-day functioning of the facility as we did so. Jeff seemed in no hurry to rush us through, so we took full advantage of his generosity by peppering him with questions regarding every aspect of the Herpetarium and its resident creatures. Much to Jeff's credit, he fielded all of our queries with alacrity. It was readily apparent that he took a great deal of pride in his herpetile assemblage, and was more than happy to allow us to linger and enjoy the fruits of his labors.

Herp highlights included:

- A breeding colony of tuataras. Seldom placed on public display, these unusual animals are maintained in a large, cooled enclosure in the Herpetarium basement which mimics the climate of their New Zealand homeland. Tuataras are a true link to the age of the dinosaurs, being the sole surviving representatives of the ancient reptilian order Rhynchocephalia, a group which flourished some 225 million years ago.

According to Jeff, breeding these endangered reptiles has yet to be successful because of a number of impediments inherent to the species. Among these are the fact that the animals don't become sexually mature until they are 11 to 13 years of age. Females produce eggs only once every four years with a gestation period of six to 10 months followed by an incubation period of 12 to 15 months. Nonetheless, Jeff was confident that it was merely a matter of time before a captive-bred generation of tuataras becomes a reality at the St. Louis Zoo.

- Koko the Komodo dragon. Not exactly a "ball of fire," Koko lay sprawled out at the front of her enclosure, looking as if the mere act of respiration required all the energy she could muster. She paid me the ultimate compliment of raising a scaly eyelid to survey me as I bent down to observe her at close range. I could only guess that Koko was a juvenile judging from her moderate size, and would in time grow into one of those hulking varanids familiar to viewers of the Discovery Channel. Hopefully I'll be able to return in a few

years to check on her progress.

- A wonderful desert habitat display featuring a variety of herps including tortoises, lizards and snakes. The enclosure was spacious and realistically portrayed a segment of a North American desert ecosystem, with each of the animals occupying the same niches as they would in the wild.

- An impressive assortment of viperid snakes from all over the globe, beautifully displayed in naturalistically appointed enclosures.

- A fantastically colored Fijian banded iguana with its intriguing orange eyes and contrasting pattern of lime-green, azure and white.

- A piebald bullfrog that I didn't actually see, but judging from the enthusiastic comments of those who did, must have been an amazing sight.

My group didn't exit the Herpetarium until almost 3:00 P.M., leaving us precious little time to see the remainder of the zoo before our scheduled departure at 4:00. The few exhibits that I did manage to see included the avian house and the outdoor free-flight enclosure. Both were equally as impressive as the Herpetarium, leaving me with an overall favorable impression of my all-too-brief visit to the St. Louis Zoo. Someday soon I hope to find my way back to this fine facility (probably not by Midwestern Motorcoach) and thoroughly explore it at a more leisurely pace.

As our motorcoach glided through the flatlands of Illinois in the golden twilight of a glorious summer evening, our tired spirits were once again lifted through the magic of videotape as we all watched the cinematic gems "Alien Resurrection" and "Buddy." "Buddy," the true story of a gorilla raised as if he were human by a wealthy, eccentric woman in the early 1900s, carried an especially poignant message considering the pro-wildlife orientation of everyone on the bus. I think it is safe to say we all learned that if one attempts to make a gorilla wear a suit and perform menial chores around the house, he will at some time rise up and throw off the shackles of his oppression. Best hope that you are not anywhere in his vicinity when he decides to do so.

As we cruised on into the night, all thoughts turned toward the Chicago Bulls and their pursuit of a sixth NBA championship. Game 6 of the finals was being played that very evening with the Bulls pitted against the Utah Jazz. The Bulls were up three games to one in the series with a chance to clinch. The lure of Buddy was strong, but the lure of M.J. was stronger.

Jenny Vollman, possessor of the only radio on the bus (one of those personal models only audible through headphones) listened intently to the contest, relaying the action as it happened to those on board. Jenny's husband Ralf worked in tandem with his wife, contorting his arm as he adjusted the radio's position per Jenny's instructions in an effort to keep the weak signal from fading completely.

The scene was surreal as we drove through the darkness, the interior of the bus lit only by the flickering glow of the six video screens bearing the image of a well dressed gorilla, with

Jenny monitoring the radio like some wireless operator from a bygone age.

Shortly before reaching the outskirts of Chicago, cheers resounded throughout the bus as Jenny relayed the happy news that the Bulls had won their sixth title. She appeared worn from her impromptu stint as sportscaster, yet seemed pleased to have been able to provide such an invaluable service to her fellow Bulls fans. Her husband Ralf should also be acknowledged for taking on the thankless duty of radio manipulator. Without his undying devotion to his wife, we all would have

missed this great moment in Chicago sports history.

Special and voluminous thanks go out to Audrey Vanderlinden who was the spearhead and organizer of this entire St. Louis Zoo extravaganza. She also served as room-mother, keeping a substantially sized group of herpers informed, entertained and on the same page throughout the course of this adventure. Now, if we can just work on her taste in movies . . . just kidding, Audrey. Thanks for a job well done.

Thanks for your indulgence. See you next month.

Bull. Chicago Herp. Soc. 33(8):173-176, 1998

HerPET-POURRI

by Ellin Beltz

Do cane toads eat Asian longhorned beetles?

Perhaps the top news story in all Chicago area media is the discovery of Asian longhorned beetles, mature and breeding in trees in a heavily forested residential neighborhood in the city. Quick surveys revealed the extent of the infestation to include two beautiful cemeteries (Rosehill and Graceland) and an area from the Clark Street beach ridge west to the Chicago River. The beetles apparently arrived as larvae in wooden crates shipped from their native China. Infested trees will have to be cut and burned as soon as the beetles go into hibernation. Homeowners and residents of the area are (of course) quite upset and concerned. Introductions of non-native plants and animals have been reported regularly in this column. Readers are strongly urged never to release an animal that has been taken into captivity — especially not one that doesn't even come from the area! Otherwise environmental disruption is caiman soon to a neighborhood near you, too. Entomologists have also recorded two new species of termites in Florida and Hawaii. *The Times-Picayune* reports, "If the spread of these termites, major pests in their home territories, is anything like that of the Formosan [termites], the Gulf Coast, Hawaii and perhaps other parts of the country will be waging termite wars on multiple fronts. With infested wood being transported freely . . . invasions of new foreign termites [may] become routine in Miami and other southern ports." Researchers suggest that the bugs may be arriving on pleasure boats, on firewood, or crates. [July 2, 1998, from Ernie Liner] Meanwhile, brown tree snake experts held a three-day symposium in Hawaii where they discussed new trap strategies, snake baits and snake-detecting dogs. Since the terriers were first used on Guam to check outgoing cargo in 1994, only one brown tree snake has been confirmed arriving in Hawaii compared with five snakes, one in each of the previous five years. About 10,000 snakes are captured a year on Guam, and the snakes have eliminated nine of the island's 11 species of endemic birds. [Arkansas Democrat-Gazette, July 25, 1998, from Bill Burnett] Don't forget American red-eared sliders and bullfrogs terrorizing Britain, eating the fauna of France and themselves becoming the cuisine of Asia; they were originally shipped as pets, and when the novelty wore off, were released. What we're seeing before our very eyes is the ends of our

ecosystems and the development of a cosmopolitan world flora and fauna — a world, unfortunately where only the adaptable may survive.

70 years ago . . .

On June 26, 1926, a 3½-foot-long snake native to eastern Asia and Australia was found on the pavement in College Road, Cork, Ireland. It was believed to have come from a bunch of bananas left in a fruit importer's car at a grocer's shop. [*The Irish News*, June 26, 1998, from Wes and Kim von Papineäu]

Turtles and frogs at school

- About 100 Ohio high school Environmental Club and science students worked together on a natural history catalog of plants and animals on a 10-acre site near the school. In addition, they studied turtle movements and plotted their data. It looks something like a football play-by-play chalkboard. Art classes, French language classes and even the math department have been using the turtle data. The latter use turtle movements to teach algebra and trigonometry. [*Box Turtle Research and Conservation Newsletter*, Edition 7, June 1998, from Heather Kalb] Read the rest of it on their website <<http://www.bio.tamu.edu/users/heather/boxturt.htm>> .
- Students at a Larkspur, California, school discovered that they couldn't release 60 *Xenopus* frogs they had raised from tadpoles ordered from a Wisconsin biological supply house since the African clawed frogs present both a disease and predation risk to native and endangered species. The whole thing has been quite a lesson for the kids who have been turned into ardent conservationists. One parent took the frogs home while the school, students and parents debate what to do with them. Another parent suggested sending them back to the supply house! [*Times-Standard*, Eureka, California, from Bradford Norman]

"Mad Salamander Disease" limits cannibals

It's been known for a while that if you crowd young tiger salamanders, they may develop into "cannibal morphs." They're larger, widebodied and widemouthed versions of the

regular tiger salamander with the usual engaging tiger salamander personality and feeding habits. And they swim. I've always been really glad they stop at 10 inches. Larger and yuppies might have some competition. Now comes a new study on just why all salamanders don't turn cannibal since those that do grow so large, so fast. Turns out that a serious hemorrhagic disease is transmitted by cannibalism and salamander eggs from areas where the disease is endemic are less likely than others to develop into cannibals. [*Science News*, May 9, 1998, from Mark Witwer]

Not all gloom and doom on the amphibian front

- Arizona frogs are disappearing at an alarming rate. Researchers and legislators fear that the dying frogs and salamanders may be sending us a message about our environment. Proposed causes of decline specific to Arizona include acid rain from copper smelters, introduction of non-native crayfish, a virus from non-native fish, and predation from introduced bullfrogs and bass. These or other human-influenced environmental changes are often implicated in global frog declines. Species gone or in decline include Tarahumara frogs, Sonoran tiger salamanders, barking frogs, mountain treefrogs, lowland leopard frogs, Chiricahua leopard frogs, and Sonoran green toads. Ten of the 25 species of Arizona amphibians are of "special concern" to the state's Game and Fish Department. [*Tribune*, May 5, 1998, from Tom Taylor]

- "The Arizona *Daily Star* reported a newly discovered fungus appears to be the cause of an epidemic killing frogs and toads in rainforest in Australia and Central America, and may be the reason amphibians are in decline around the world. The large numbers of dead frogs found as part of an international study were 'just stunning' said David Wake of the University of California at Berkeley." [*Greenlines* #658, from Roger Featherstone] The fungi are usually found in the soil, where they assist in the breakdown of rotting material. [*San Diego Union Tribune*, July 7, 1998, from Claus Sutor] As the story proceeded around the world, the *Arizona Tribune* reported that the chairman of the biology department at Arizona State University said, "Chytrids have always been around. We need to look at why frogs are getting infected now." [July 27, 1998, from Tom Taylor] Meanwhile *New Scientist* provides the full tale. It seems as though the fungus covers animals' bellies and legs and ends up suffocating the amphibians by blocking through-skin respiration. It has been found to be a new genus of a group of fungi related to the earliest life on earth. Chytrid fungi have never before been found to cause disease in vertebrates. The fungus was first noticed in a captive colony of arroyo toads (*Bufo microscaphus californicus*), but has been confirmed from specimens collected in western Panama, captive poison-dart frogs at the National Zoo, in ten species in Australia and three other American zoos, including the Shedd Aquarium in Chicago. An experimenter put healthy frogs in water with skin scrapings from infected frogs. The formerly healthy frogs died. [June 30, 1998, from David Blatchford] New guidelines on handling and moving amphibians were prepared in an effort to stop the spread of the fungus by herpetologists. Get a copy by E-mailing <DAPTF@open.ac.uk>.

- When the Americas were first being explored for scientific specimens, an explorer named Pier Kalm sent many specimens back to Carl Linnaeus at Uppsala, Sweden. Among them was one which stuck in my mind—it was a treefrog collected on Manhattan Island. That's where I was born and grew up. The island of my memory is more choking bus and car fumes, tightly packed canyonlike buildings surrounding one oasis of green than a moist, mesic environment suitable to support fragile treefrogs. Central Park was very nice when I was a child, but no one dared go north of 90th as there were all sorts of urban predators. In the 70s and early 80s the Park turned into a total weirdo habitat and the plants, trees, soils and waterways took a severe beating from overuse. The Parks Department realized what was being lost, but rather than just restore a Victorian garden, they took the opportunity to begin to try to replace original species lost to urbanization and all its ills. They are also working on a five-borough tapestry, not just improvements in Central Park. So far their program has butterfly weed blooming in Brooklyn, wood frogs calling in Queens and woodchucks chucking or whatever woodchucks do in the Bronx. Other reintroductions have included box turtles in Staten Island, luna moths in Manhattan, screech owls, bobwhite and weasels. Some of the project's introductions haven't worked, and researchers admit that the whole concept is rather "romantic . . . [but] a shot in the dark." [*New York Times*, July 13, 1998] Someone should make a song about this, "I knew an ol' agency that released a fly, then released a spider to catch the fly, a frog to catch the spider, a garter snake to catch the frog . . ."

- Last seen in Minnesota 17 years ago, a colony of northern cricket frogs was found in a swampy area not far from St. Paul by mosquito control workers. The director of the FrogWatch program center said, "I've seen the frog with my own eyes and touched the little critter. We're very excited." [*Reuters*, June 25, 1998, from Wes and Kim von Papineau]

- Four or five male red-legged frogs have been calling at the Santa Rosa Plateau Ecological Reserve, but researchers haven't seen any females. The frog is the same species as that in Mark Twain's story, "The Celebrated Jumping Frog of Calaveras County," and we all know that Twain enjoyed his reputation as a liar, but even I cannot believe the following statement quoted verbatim from the *Eureka Times-Standard*: "At night, researchers and volunteers with tape recorders and flashlights scour the reserve listening for the female's love song." The frogs were first seen on the plateau nine years ago, and listed in 1991 as a threatened species by the U.S. Fish and Wildlife Service. [June 8, 1998, from Bradford R. Norman]

Laws, lies and videotape

- After thoroughly discussing all federal, state, local and international venomous-snake-owning laws, acts, permits and import regulations, and their various penalties, the Superintendent of the endangered species protection unit in South Africa said "You must decide what's more venomous—us, or the snake you illegally own." [*The Saturday Star*, November 4, 1997, from Wes and Kim von Papineau]

- The July 15, 1998, *Chicago Tribune* reported that a “jumbo boa” was found under a bush in an alley on the West Side of Chicago. It was identified as a boa constrictor by a veterinarian with Animal Care and Control. The 12-foot snake was installed in an aquarium at Animal Care and Control and a police sergeant said, “Based on its size, I would say it’s pretty valuable. Somebody must have kept it a while to get it that big.” Two days later, the same paper reads, “Stray python likely to get new home after law puts squeeze on owner.” Seems in two days, somebody at AC&C figured out that 12-feet is over the limit for Illinois “dangerous animals act.” The owner showed up to claim the snake with veterinary records and alleged it was stolen from its home about two miles from where it was found. The AC&C persuaded her to sign over custody of the snake to the city rather than taking it back to face prosecution under the act. [all from Claus Sutor and Ray Boldt who wrote “Note that the snake changed from a boa to a python overnight.”]

- When police arrived at a Benton, Arkansas, home after reports of shots fired, they found two men sitting on a sofa. While both appeared to have been drinking, one man had a gunshot wound in his side. He told the deputies that his pet iguana had shot him. A woman who also lives there told deputies that the iguana was sitting calmly in its cage at the time of the shooting. [*Arkansas Democrat-Gazette*, June 21, 1998] Contributor Bill Burnett wrote, “When guns are outlawed, only iguanas will have guns!!!”

- Fifteen people were arrested on felonies and misdemeanors for allegedly selling endangered animals at a reptile show at the Indiana State Fairgrounds. NBC News reported that the raid was designed for television cameras, allegedly showing conservation officers and police buying native species from Indiana or venomous animals. [June 29, 1998, from Wes and Kim von Papineau] The local newspapers covered the event in great detail, *The Times* reporting “The massive investigation began after the Department of Natural Resources determined Indiana was a laundering state for reptiles and amphibians because of little or no regulatory or statutory controls. There was a lot of trading done that would have been illegal in other states, the DNR said. Undercover DNR officers gained the confidence of dealers and went on collection runs in Indiana and out of state. Officers documented the illegal trade of endangered species, native species and dangerous and venomous species. . . . DNR officers in uniforms discussed the [emergency order enacted January 1] with dealers, but the DNR said that . . . some dealers sold to undercover DNR officials and told them about the rules they were breaking. The DNR said the Midwest Reptile Swap Meet . . . [in] Porter County was at the center of the investigation. [June 30, 1998] The *Chesterton Tribune* wrote: “Dealers in illegal reptiles and

amphibians went from predators to prey Sunday as Indiana conservation officers sprung a trap two years in the making.” [June 29, 1998, both from Jack Schoenfelder]

And a nod to her Latin teacher

A paper in the July 2 issue of *Nature* contains the new species *Eucritta melanolimnetes* a fossil that resembled salamanders with big heads and big feet that lived near present-day Edinburgh, Scotland, 333 million years ago. The husband/wife team found the creature, a nearly complete skeleton about 8 inches from snout to vent. The name is derived from the Greek “Eu,” true added to American slang. In combination with the specific name *melanolimnetes*, the new tetrapod’s name translates to “true critter from the black lagoon.” [*Chicago Sun-Times*, July 3, 1998, from Ray Boldt]

Double click to start

We’ve all been told that it’s only the males who call for sex in the frog world, but researchers working with *Xenopus laevis*, the African clawed frog, have found that female clawed frogs produce percussive clicks described as similar to the sound of a Geiger counter. The male replies with the trill and mating follows. A researcher said, “one could think of the female’s advertisement call as a general love song and the male’s answer call as a serenade to a specific love object.” [*National Wildlife* 36(5), August/September 1998, from Mark Witwer]

No glo-in-the-dark turtles, yet

Opponents of a nuclear waste site in the California desert, including Native Americans, have occupied the site west of Needles last February while waiting for legal decisions which they hope will prevent the site from being used as a “low-level nuclear depository.” The proposed operator of the site has a history of allegedly leaving behind Superfund sites. Desert tortoises and Native Americans have lived in the area for centuries. The protest has now surpassed Wounded Knee as the longest-lasting Native American-led occupation in U.S. history. [*EcoNews*, Arcata, California, June 1998, from Bradford R. Norman]

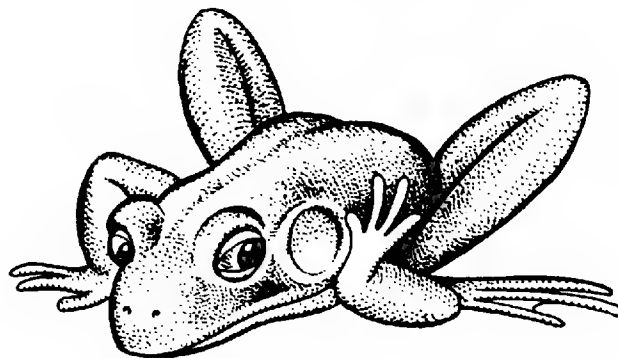
Thanks to everybody who contributed and to Bill Burnett, Ernie Liner, Ray Boldt, Paul L. Beltz, Bradford R. Norman, Claus Sutor, Phil Averbuck and Jim Stuart for stuff I enjoyed reading but didn’t use this month. You can contribute, too. Take the whole page out of a newspaper or magazine, make sure the date/publication slug is on it (or write or stick it on with tape). Put your name on the clipping and send to: Ellin Beltz, 1647 N. Clybourn Avenue, Chicago, IL 60614-5507. Contributors are all acknowledged! Cards, letters and photos also appreciated. Letters only to my E-mail <ebeltz@ripco.com>.

The Tympanum

Beyond Iguana Squad

Participating in the CHS shows over the past few years has been extremely satisfying in two areas for me. One is observing visitors who may fear or loathe our beloved animals become enlightened not only about their beauty, but about the complexities of their physiology and behavior. The other is watching reptile enthusiasts study animals in our collections that they have not had the opportunity to see or learn about at such close proximity.

This year's ReptileFest provided another highlight of a more serious nature. The newly formed Iguana Squad was on hand to teach proper green iguana husbandry to the throngs of iguana-owning visitors. An additional mission of the Squad was to make the public aware of lesser-known iguanid lizards. Donations were being accepted with the intention of being sent to the Florida-based International Iguana Society to help with the protection of the largest group of endangered lizards in the world, the rock iguanas of the West Indies. The genus *Cyclura* contains eight species, four of which are further divided into three subspecies each, and one of which contains two subspecies. The situation is unusual in that so many of the subspecies inhabit their own small islands. With the exception of the threatened rhinoceros iguana, *Cyclura cornuta cornuta*, and the Cuban rock iguana, *Cyclura nubila nubila*, (both of which are listed on CITES Appendix I), all forms are endangered. The most critically endangered are from Booby Cay (*Cyclura carinata bartschi*, estimated 200 in existence), and from Sandy or White's Cay (*Cyclura rileyi cristata*, estimated 173 in existence, including only eight females). The International Iguana Society has been working closely with the people native to these islands in an effort to remove feral animals that could ultimately cause the demise of the iguanas. After two successful trips last year to Booby Cay, the dedicated IIS group thought the feral animal problem was solved. Recently it learned that efforts to transfer problem animals to the mainland were not mobilized as quickly as promised. Another session of negotiations and assistance is necessary. It is very costly for the small, nonprofit International Iguana Society to make trips to the West Indian islands for the iguana



projects. Funds collected by Iguana Squad at ReptileFest will allow an IIS representative the one additional trip needed to ensure the survival of the magnificent iguanas of Booby Cay.

The Chicago Herpetological Society always has stressed education proudly, and I am pleased to say efforts are

being made to include conservation in the scope of activities that constitute ReptileFest.

Update:

Within the last week, we have learned that two-thirds of the goats have been removed from Booby Cay, and taken to the mainland of Mayaguana. Survival of *Cyclura carinata bartschi* in the wild is almost assured. With the assistance of herpetological societies and individuals, the IIS is hoping the island of Booby Cay will be established as a national park in the near future.

Current conservation efforts by the IIS are now focused on the plight of *Cyclura rileyi cristata*.

Respectfully submitted by Lori King-Nava, ReptileFest Co-Chair

Dear Ellin Beltz and Dr. Sherman Minton:

I read in the July issue of the *Bulletin* of the CHS your exchange regarding deformed frogs and historical accounts thereof. Probably you both are already aware of the following article, but just in case you haven't seen it, I thought I'd mention that there is an incredible well researched review of historical accounts of amphibians with supernumerary limbs. To me it is surprising that this article is very seldomly cited in the mutant frog literature of late.

Van Valen, L. 1974. A natural model for the origin of some higher taxa. *J. Herpetology* 8(2):109-121.

Andrew J. Crawford, Committee on Evolutionary Biology, University of Chicago, 1025 E 57th Street, #402, Chicago, IL 60637. E-mail: <crawford@uchicago.edu>.

Herpetology 1998

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

CAIMAN POPULATIONS IN BRAZIL

P. Brazaitis et al. [1998, *Amphibia-Reptilia* 19(2):193-201] investigated the distribution and relationships among populations of *Caiman crocodilus crocodilus* and *Caiman yacare* throughout Brazil. *Caiman c. crocodilus* inhabits the drainages of the Rio Solimões/Rio Amazonas, Araguaia, Araguari, Itapicuru, Paranaíba, Negro, Tapajos, Tocantins, Xingú, and the rivers draining to the Atlantic Ocean on the northern coast of Brazil. It does not occur in the Rio São Francisco. *Caiman yacare* is endemic to the Rio Mamoré, Rio Guaporé, Rio Paraguai and Rio Paranã river systems and all of their lowland drainages. The northernmost limit for *C. yacare* lies between Costa Marques (12°25'S, 64°10'W) and Guajara Mirim, Pacaas Novos on the Rio Mamoré (10°55'S, 65°15'W). Small populations of apparently hybrid individuals were observed in the upper Rio Acre, the Rio Abunã, the upper Rio Madeira, and the Rio Mamoré between Guajara Mirim and Abunã. *Caiman c. crocodilus* and *C. yacare* populations are geologically separated and morphologically distinct. These studies suggest that *C. yacare* is the endemic species of southwestern and south-central Brazil, while *C. c. crocodilus* remains effectively isolated in the Amazon Basin.

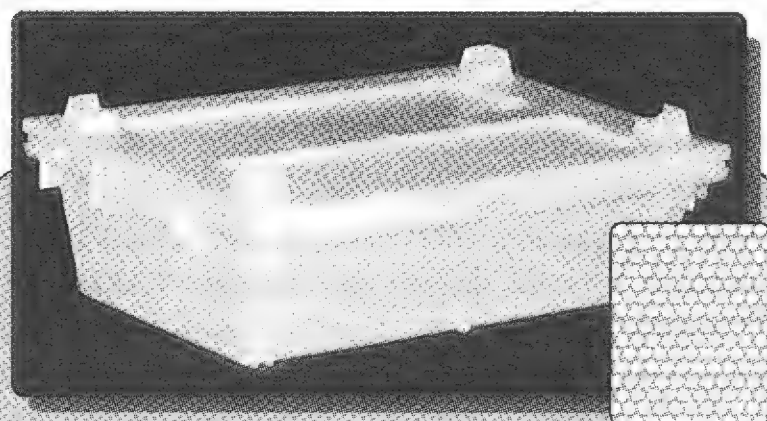
NESTING, EGGS AND HATCHLINGS OF A COSTA RICAN SALAMANDER

R. C. Bruce [1998, *Herpetologica* 54(1):13-18] located egg clutches of the salamander *Nototriton picadoi* in cloud forest habitats in Tapantí National Park, Costa Rica. He found nests in clumps of moss on the ground, on stumps, and on the trunks and limbs of shrubs and trees. Clutch size varied from 1 to 8. Clutches were not brooded by females. He also found clusters of empty egg capsules. The temporal distribution of viable eggs and empty capsules suggested that oviposition begins early in the wet season (May), continues for several months, with hatching completed by the end of the wet season in December. He raised hatchlings from eggs in the laboratory, and recorded their morphology and coloration. The embryonic period appears to be 2.5-3.0 months. The absence of attending females at clutches may reflect a tradeoff between the advantages of parental care in plethodontid salamanders versus the inherent risks of egg brooding in small tropical salamanders. The author suggests that in *Nototriton* the tradeoff involves adaptations of the egg capsule itself, which minimize desiccation, predation, and, or, fungal infection.

Health Food for your herps!



Highest quality rodents are available in all sizes from pink mice to jumbo rats. Fresh frozen crawler mice are only 17¢ each in lots of 2,000. All frozen animals are shipped in insulated boxes.



Nearly 9,000 holes and they still can't escape!

The new TTC is ideal for transporting, breeding and storing your mice, rats, snakes and lizards. The strong plastic TTC has over 2,200 holes on each side and over 4,500 holes on the lid to provide maximum air circulation even when stacked. Each TTC can be divided into 2, 3 or 4 compartments and its smooth plastic construction makes washing a snap.

273 Hover Avenue • Germantown, NY 12526-5320
518-537-2000 • Fax 518-537-7287

Unofficial Minutes of the CHS Board Meeting, July 17, 1998

The meeting was called to order at 7:36 P.M. Ron Humbert was absent.

Officers' and Committee Reports

The minutes of the May Board of Directors meeting were read, corrected and accepted.

The Treasurer's report was read and accepted.

Membership: Current membership is 1024.

President: A nominating committee has been selected. Ilene Seivert will be chairing the committee. Other committee members are Ron Humbert, Lori King-Nava, Byron de la Navarre and Bob Ryan. Anyone interested in running for a BOD position should contact a nominating committee member.

Vice-president: Jack Schoenfelder reported that speakers for general meetings are booked through January 1999. A guest speaker has been added to the agenda for the July general meeting. The Shedd Aquarium is currently hosting the Conservation Training Consortium (CTC). The CTC is focusing this year's training on conservation of aquatic environments. Zsolt Csaba Török (a.k.a. Joe), a CTC member, is the founder of the first Romanian herpetological organization. Joe will provide a short presentation on herpetology in Romania which will be followed by the Expert's Corner featuring herpetocultural and veterinary experts.

Shows: ReptileFest '99 is provisionally slated for the first weekend in May at Northeastern Illinois University. The University contacted the CHS to do a spot on their radio station about the society and our annual show.

Illiana Garden Pond Society—Ron Humbert, Jennie Picciola and Jack Schoenfelder will be discussing keeping (or not keeping) reptiles and amphibians in backyard ponds at Crystal Palace Perennials on July 18, 1998. The CHS was invited to return again this year after an enlightening presentation in 1997.

Windy City Pet Expo—The CHS will participate in this annual show again during the weekend of October 9–11. Interested exhibitors should contact Jenny Vollman.

Field Museum Members' Night—A team of CHS members will represent the society on July 23 and 24.

Old Business

Picnic: The CHS picnic is set for August 2. Games, including volleyball, are planned for this event. This will be a pot-luck picnic. Soda and ice water will be provided. The festivities start at noon at the Catherine Chevalier Woods. Maps will be available at the July general meeting.

Zoo Trip: The trip to the Herpetarium at the St. Louis Zoo was successful. Ideas for next year's road trip are welcome.

Website: The website is now being hosted on the CAS server.

New Business

Jack Schoenfelder moved to reimburse Steve Spitzer \$50 for expenses incurred from the necessary euthanasia of a snake. The motion was seconded by Mike Dloogatch and was unanimously approved by the board.

A proposal was submitted to the CHS by Rob Carmichael Director of the Wildlife Education Outreach Program of the Lake Forest Recreation Department (LFRD). The board unanimously approved a motion to donate \$500 to the Lake Forest Recreation Department. The motion was made by Mike Dloogatch and seconded by Jenny Vollman. The money will be used to purchase display cages and to erect signage in an effort to educate the community about the valuable role reptiles play in the natural world. The LFRD will display a sign thanking the CHS for the contribution.

The board voted unanimously in favor of establishing an exchange membership with the German herpetological society, DGHT, which publishes the journal *Salamandra*. The motion was made by Mike Dloogatch and seconded by Lori King-Nava.

Jack Schoenfelder showed the board members a wall clock he had received with the CHS logo on its face.

Round Table

Jack Schoenfelder reminded the board that the September BOD meeting is still scheduled to take place at his summer home in Michigan. The board agreed that the meeting should be held on Saturday, September 19, to allow everyone time to arrive.

Gary Fogel informed the board that his garage may soon be available for rent to store CHS materials.

Jennie Picciola thanked everyone who came out south for the ReptileFest debriefing meeting. Lori thanked Jennie's parents for hosting the aforementioned meeting, especially for the meatless salad.

Audrey Vanderlinden discussed the upcoming National Breeders' Expo in Orlando.

The meeting adjourned at 9:30 P.M.

Respectfully submitted by Recording Secretary Jennie Picciola



THE GOURMET RODENT™

VISA MasterCard American Express

RATS AND MICE

Bill & Marcia Brant
6115 SW 137th Avenue
Archer, FL 32618
(352) 495-9024
FAX (352) 495-9781
e-mail: GrmtRodent@aol.com

© All Rights Reserved

Advertisements

American Federation of Herpetoculturists: A nonprofit national membership organization of herpetoculturists, veterinarians, academicians and zoo personnel involved in the captive husbandry and propagation of amphibians and reptiles. Membership includes highly acclaimed magazine, *The Vivarium*, dedicated to dissemination of information on herpetocultural accomplishments, herp medicine, breeding and maintenance, field studies and adventures, enclosure design and much more. AFH membership is \$26. Send information requests to: AFH-News, P.O. Box 300067, Escondido CA 92030-0067.

Artist wanted: My name is Jim Hatfield. I wrote the book, *Green Iguana—The Ultimate Owner's Manual* and I have an iguana column for *Vivarium* magazine. I am looking for some talented CHS member who could draw cartoons and/or iguana illustrations for my column and articles in other reptile magazines. Send me copies (*only*) of your work to: Jim Hatfield, P.O. Box 102, Lake Oswego OR 97034-0014. I will then get in contact with you.

Breeders' Expo: Atlanta Georgia's 3rd annual Breeders' Expo is September 5, 1998. **Only non-venomous, captive-bred animals.** Contact Georgia Herpetological Society, P.O. Box 464778, Lawrenceville GA 30046, or David Bowman at (770) 505-0547, for more information.

For sale: *Bulletin* boxes, \$10 each. Library quality with "Chicago Herpetological Society" imprinted. Each container holds about two years' worth of *Bulletins*. Send check or money order to Chicago Herpetological Society, 2060 N. Clark Street, Chicago IL 60614. Allow four weeks for delivery.

For sale: rats and mice—pinkies, fuzzies and adults. Quantity discounts. Please send a SASE for pricelist or call Bill Brant, *THE GOURMET RODENT*, 6115 SW 137th Avenue, Archer FL 32618, (352) 495-9024, E-mail <GrmtRodent@aol.com>.

For sale: murine-pathogen-free rats and mice available in all sizes, live or frozen: pinkies, fuzzies, crawlers, small, medium and large. Frozen crawler mice in lots of 2000, \$.17 each. Also available, full grown hairless mice. FOB shipping point. Master Card accepted. Call (518) 537-2000 between 8:00 A.M. and 5:00 P.M. or write SAS Corporation, 273 Hover Avenue, Germantown NY 12526 for prices and additional information.

For sale: from **The Mouse Factory**, producing superior quality, frozen feeder mice since 1989. Our mice are frozen separately and vacuum-packed to greatly extend freezer life by reducing freezer burning and preserving vitamin and nutrient content. We feed our colony a nutritionally balanced diet of Mouse Chow and four types of natural whole grains and seeds. Prices: pinkies, \$25/100; fuzzies, \$30/100; weaned, \$35/100. Quantity discounts available. Ray Queen, P.O. Box 85, Alpine TX 79831. Call (800) 720-0076 or E-mail us at <mousefac@overland.net>. Fax (915) 837-0156.

For sale: from Bayou Rodents, excellent quality feeder mice and rats. Every size available. Pinks starting at \$20/100. Orders are shipped by overnight service Monday thru Thursday. We accept Visa, MasterCard and Discover. For more info, contact Rhonda or Peggy, (800) 722-6102.

For sale: **high quality frozen feeders.** Over a decade of production and supply. Seven sizes of mice available: small newborn pinks up to jumbo adults. Prices start at \$25 per 100. Feeders are separate in the resealable bag, not frozen together. Low shipping rates. Free price list. Kelly Haller, 4236 SE 25th Street, Topeka KS 66605, (913) 234-3358 evenings and weekends.

For sale: In stock, Flex-watt and Ultra-therm heating products. **Frozen rodents** always available. Mice: pinks—crawlers, 3/\$1; weanlings, 40¢; subadult, 50¢; adults, 65¢; large adults, 75¢. Rats: small, 85¢—\$1; medium, \$1.25–2.00; large, \$2.25–2.75; jumbo, 3/\$10. Call on quantity discounts [note: discount on orders picked up at CHS meetings]. Live rodents available at higher prices. **Available now:** newsletter/catalog—many unique/hard-to-find herp husbandry items. Send business-size SASE for catalog, or call. Scott J. Michaels, D.V.M., Serpent City, P.O. Box 657, Island Lake IL 60042, (815) 363-0290.

For sale: Herp bags—colors vary, translucent ripcord nylon, super lightweight, extremely durable construction with hot corners sewn in, double seamed. Custom sizes made upon request. Sizes: 46" × 14", \$7 each; 24" × 12", \$6 each; 24" × 6", \$5 each. Shipping fees, \$1 for first bag, \$.30 each additional bag. Nicole Lechowicz, 290 Warren Road, #69, Carbondale IL 62901, (618) 457-2783.

For sale: sheets of smoked Plexiglas—22½ × 54½, 27½ × 54½, 22½ × 60½, 11½ × 54½, 11½ × 61, 27 × 60. Dave, (708) 422-6221.

For sale: books. *Cobras in His Garden* by Harry Kursh, 1975 (1965), 192 pp., b & w photos, DJ—Bill Haast's biography, \$37; *Giant Reptiles* by Minton and Minton, 1973, 345 pp., b & w photos, DJ, \$32; *Reptiles Round the World* by Clifford Pope, 1957, 194 pp., many drawings, ex-lib., \$20; *The Zoo* by Dr. Peter Crowcroft, 1978, 160 pp., many excellent color and b & w photos including Australian species, DJ, experiences and zoo philosophy by the former director of the Brookfield and Taronga Zoos, one page missing, \$22. All books hardbound in very good to excellent condition except as noted. Prices postpaid. William R. Turner, 7395 S. Downing Circle West; Littleton, CO 80122 (303) 795-5128 eves. and weekends.

For sale: Selling most of my collection. Great prices—some freebies! Some herps, but mostly arachnids. Andy Davies, (773) 279-1541.

For sale: to responsible froggers, my *Phyllobates vittata* juveniles, well-started, for pick-up in Evanston or delivery to CHS meeting—no shipping, \$15 each in groups of three or more. Ilene, (847) 864-5513.

For sale: captive hatched/born reptiles. Male frilled dragon, hatched May 1996, \$250; two frilled dragons, hatched March 1998, \$150; 1998 hatchling tortoises—redfoots, \$100 each, pancakes, \$300 each, Hermann's, \$125 each. Also available: 1998 young: lined geckos, \$15 each; ocelot geckos, \$25 each; corn snakes, Okeetee and red albino, sexed and feeding, \$20 each; rosy boas, sexed and feeding, \$50 each. For more information call before 10:00 P.M. CDT, (918) 342-2159. Ask for Linda.

For sale: c.b. inland bearded dragons, *Pogona vitticeps*, father German giant red phase, mother g.g. gold phase, \$40 and up. Katie, (815) 467-2201.

For sale: frilled lizards, hatchlings to adults, all localities, even the spectacular red phase from the Northern Territory. Find your cheapest price and then call me. I am selling Australian bloodlines for the same price as you will pay for New Guineas! Also, one male, 6-year-captive emerald tree boa, \$300. Ed Marino, (410) 557-9197. [MD]

For sale: Northern blue-tongue skink, c.b. '95, gender unknown, \$125; San Felipe rosy boa, male c.b. '95, \$125; large female corn snake (normal phase, poss. hetero for striped) c.b. '93, \$35. Chicago pick-up only. Mark, (773) 693-1030.

For sale: c.b. '98 snakes. California kings, \$20; Sinaloan milks, \$55; Honduran milks, \$80; gray-banded kings, \$85; Leonis kings (*thayeri*), \$80. Also, adult female Brazilian rainbow boa, \$250. Various other single colubrids available; trades considered. Henry Cohen, 24 St. Johns Place, Buffalo NY 14201, (716) 881-6724.

For sale: three male Arizona mountain kingsnakes, c.h. '94, proven breeders or make great pets, get adults at hatchling prices, \$75 each; one male and one female Arizona mountain kingsnakes, c.h. '97, \$130/pair; one male and two female Pueblan milksnakes, average to good color, c.h. late 1996, about 25" long, \$140/trio; female mid-Baja rosy boa, beautiful orange/gray, pick of the litter, c.b. late 1996, \$55. Shawn Bjerke, P.O. Box 5818, Fargo ND 58105, (701) 235-7263.

For sale: c.b. California kingsnakes, all feeding well, \$25; c.b. bearded dragons, \$25. Rich, R&D Exotics, (708) 485-5705 after 6 P.M. or leave a message or E-mail <rcrowley@anl.gov>.

For sale: 12 *Lampropeltis mexicana thayeri*, all from peach parents—peach phase, \$200 each, regular, \$60 each; one male and three female adult Argentine rainbow boas, captive raised, \$1500/group; three 2-year-old female diamond/carpet, \$275 each. Doug, (707) 745-5583. [CA]

Advertisements (cont'd)

For sale: Cutting back collection size. Two male and one female adult Dumeril's boas, *Acrantophis dumerili*, 6-7', \$800/pair; one male and one female Australian olive pythons, *Liasis olivaceus*, \$800/pair; two male and two female Sawu Island pythons, *Liasis savuensis*, adults in collection for six years, \$700/pair; two male and two female Timor pythons, *Pythom timorensis*, 7 years old, 8', \$6000/pair; 18 male and 11 female rough-scaled sand boas, *Eryx conicus*, (July), \$100/pair. All adult snakes are long term captives or c.b. David Sorensen, 4100 N. 78th Street, Milwaukee WI 53222, (414) 463-6164 or E-mail <davesor@execpc.com>.

For sale: The Snake Lady has albino corns, hypo corns, ball pythons (eating well), Burmese pythons (albino and normal), boa constrictors and green tree pythons (2-year-olds and hatchlings) very tame and eating well. Blood pythons. One male Argentine boa. Albino alligator (geat investment opportunity), serious inquiries only, \$50,000 firm. Call Tonya Maris for more info and current price list, (630) 851-2331 phone, (630) 851-9672 fax.

For sale: 1998 prospective hatchlings—Baird's rat snakes, prairie kingsnakes, California kingsnakes, \$25 each; red milksnakes, \$35 each; Mexican black kingsnakes, \$40 each; trans-Pecos rat snakes, \$45 each; albino speckled kingsnakes, Sinaloa, Pueblan, Mexican milksnakes, San Luis Potosí kingsnakes, \$50 each; Ruthven's kingsnakes, \$75 each; *thayeri*, *greeri*, graybands, \$100 each; Arizona mountain kingsnakes, \$125 each. Some breeders available. Steve Mitchener, (405) 748-6566 (after 5 P.M. CT). [OK]

For sale: **Premium captive-produced reptiles.** Piebald black pines; Brazilian rainbow boas (Lamar); blonde trans-Pecos rat snakes; Baja rat snakes; gray-banded kingsnakes (Langtry); Okeetee corns; melanistic garters (double hets); Peruvian matamatas; Mexican redleg tarantulas. Also, feeder mice and rats, husbandry items, bedding, etc. Mike Stefani, (630) 372-3936.

For sale: beautiful, tricolor kingsnakes. Send SASE for **free** list. Also, free phone consultation on snake husbandry problems as a service to the herp community. Robert Applegate, P.O. Box 338, Campo CA 91906, (619) 478-5123. Thank you for your attention.

For sale: c.b. 7/98 Burmese pythons, albino \$60 each, hetero for albino, \$35 each; two female c.b. '97 Honduran milksnakes, \$70 each; six male and 12 female leopard geckos, c.b. '98, high yellow, \$25 each; four male c.b. '98 African fattail geckos, hetero for stripe, \$35; male c.b. '97 Malaysian blood python, \$200 (and more on the way! Due to hatch soon.) All snakes are sexed and feeding on defrosted. Care sheets provided for all animals. Sue Black, (607) 264-3441 6 P.M. – 10 P.M., or E-mail <Paradox@worldnet.alt.net>. [NY]

For sale: three-year-old female redbellied snake, great eater, about 45", with large container, \$130; two-year-old male corn, about 30", \$50; female one-year-old corn, almost 2', \$30. Or make offer on any. Stephen, (847) 317-6649.

For sale: diamond and jungle carpets, \$175 each; Macklot's pythons, \$100 each; Children's pythons, \$100 each; creamsicle corns, \$40 each; albino corns, \$22 each; snow corns, \$20 each; bubblegum corns, \$25 each; candy-cane corns, \$35 each; het creamsicle corns, \$15 each; Vegas Cal. kings, \$20 each. **Adults:** creamsicle, \$60; het ghost, \$60; Children's python, \$150; ball pythons, \$175/pair; Dumeril's, \$600/pair; Argentine rainbows, \$500/pair; Haitian boas, \$150/pair; Brazilian rainbows, \$250 each; Indonesian bluetongue skinks, \$55 each. Flexwatt heat tape, \$2.50/ft, \$5 each connection. Steve Bostwick (515) 274-4580, E-mail <lialis@juno.com>. [IA]

For sale: Brazilian rainbow boas—2-year-old, 3' female, tame, healthy and a great eater, \$250—7-month-old female, \$175; lavender phase Cal. king, \$50. Mark, Strictly Serpents, (847) 854-3259.

Free: c.b. '98 peacock geckos (*Phelsuma quadriocellata quadriocellata*) FREE to CHS members if I approve your enclosure. Only in the Chicagoland area; will not ship. E-mail <c-henkle@uchicago.edu>.

Tours: Adventure tours to Madagascar! Join **Bill Love** seeing and photographing fauna and flora, heavily herp-biased, across the world's least known mini-continent. Maximum fun & photo ops assured on every trip. Contact him at: BLUE CHAMELEON VENTURES, P.O. Box 643, Alva FL 33920. TEL: (941) 728-2390, FAX: (941) 728-3276, E-MAIL: <blove@cyberstreet.com>.

Tours: **Road-riding in Costa Rica!** Treat yourself to the trip of a lifetime! Learn about tropical herps, find them, photograph them, see where they live. **Greentracks, Inc.**, offers the best herpetological tours led by internationally acclaimed herpetologists and herpetoculturists. See the Amazon, visit cloud forests, experience the world's greatest rainforest, super sunsets and good company. Call (800) 9-MONKEY.

Wanted: Photos (non-professional) of reptiles to be put on animal trading cards. These feature an animal on the front, species, origin, etc. on the back. We give these away during our outreach programs. All photos will be returned unharmed if you include your name and address. Please call Wildlife Educators at (815) 795-3959. Thank you.

Wanted: Reptile eggs (preserved), shed skins or pelts, etc. for use in outreach programs. Please call Wildlife Educators at (815) 795-3959.

Wanted: sand boas (*Eryx elegans*, *E. jayakari*, *E. muelleri* and *E. somalicus*). David Sorensen, 4100 N. 78th Street, Milwaukee WI 53222, (414) 463-6164.

Wanted: big-headed turtles; mata mata turtles; Mexican giant mud turtles (*Staurotypus triporcatus*); exceptionally large common snappers (45 lbs. & up); large alligator snappers (over 90 lbs.); spectacled caiman from Trinidad, Tobago and Surinam; dwarf caiman; smooth-fronted caiman; albino turtles (except red-eared sliders). Walt Loose, (610) 926-6028, 9:00 A.M. – 1:00 P.M. or after 11:30 P.M. Eastern Time.

Wanted: Styrofoam boxes, any size or shape so long as they're not flimsy, preferably with cardboard liners, willing to pay from \$2 to \$5. Bring to CHS meetings. Scott J. Michaels, D.V.M., Serpent City, (815) 363-0290.

Line ads in this publication are run free for CHS members — \$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to: Michael Dloogatch, 6048 N. Lawndale Avenue, Chicago IL 60659, (773) 588-0728 evening telephone, (312) 782-2868 fax, E-mail <MADadder0@aol.com>.

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, August 26, at the Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, in Chicago. Our speaker at this meeting will be Lee Weigt, a researcher at the Field Museum who has been studying DNA sequencing in Neotropical frogs. This study was funded in part by a CHS grant.

The speaker at the September 30 meeting will be Ray Pawley, former Curator of Reptiles at Brookfield Zoo. Ray will give us a report on renovations now under way at the Moscow Zoo.

We are required to use the entrance on the west side of the museum. **We are allowed to use the free parking lot to the west of the museum as long as space is available. Your best bet is to try that lot first before settling for the lot to the east of the museum or for the Soldier Field lot.** For the latest on the parking situation call our CHS message line, (773) 281-1800, before you come. Public transportation is an option: the Roosevelt Road (12th Street) bus now goes directly to the museum, thus providing a connection with the el and subway. This bus service runs until 11 P.M.

Turtle Club

The Chicago Turtle Club will meet Sunday, August 23, 1:00–3:30 P.M., at the North Park Village Administration Building, Room 105, 5801 N. Pulaski, in Chicago.

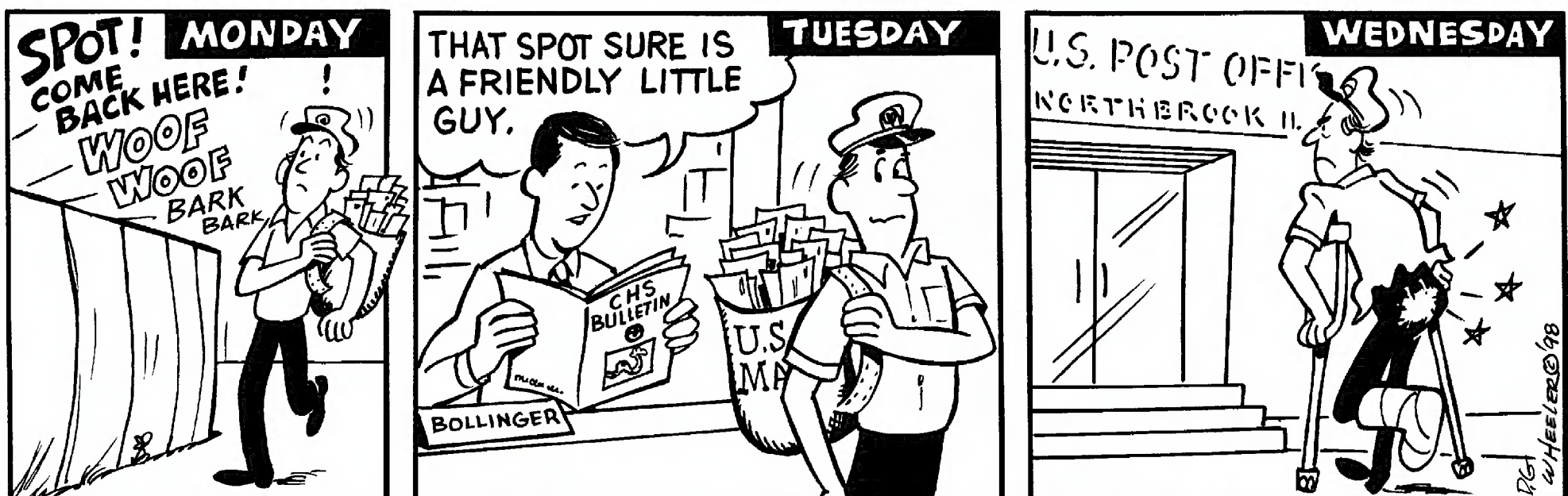
FOURTEENTH ANNUAL MIDWEST HERPETOLOGICAL SYMPOSIUM — OCTOBER 16–18

The 14th annual Midwest Herpetological Symposium will be hosted by the Hoosier Herpetological Society from Friday, October 16, through Sunday, October 18, at the Best Western Waterfront Plaza Hotel in Indianapolis, Indiana. The schedule of events is as follows: Registration will be open on Friday from 4:00 to 10:00 P.M. From 6:00 to 10:00 P.M. on Friday, sales of merchandise and captive-bred animals will take place. Also on Friday, from 10:00 P.M. on, a hospitality suite will be open for those who have registered for the symposium. Saturday's schedule includes lectures from 8:00 A.M. to 5:00 P.M., a banquet at 6:00 P.M. with featured speaker Dr. Sherman A. Minton, an auction from 8:30 P.M. on, and the hospitality suite after the auction. Sunday will feature a behind-the-scenes tour of the Desert Biome at the Indianapolis Zoo.

Saturday's speakers and their topics will include: Jeff Wines, "*Cyclura* at the Indianapolis Zoo"; Ron Humbert, "The Box Turtles of North America: Their Natural History, Current Survival Status and Comments on Natural History"; Dr. Michael J. Lannoo, "Understanding the Politics of Amphibian Declines and Malformities"; Mike Wood, "Captive Propagation and Maintenance of Gaboon and Rhino Vipers"; Dr. Sherman Minton, "Who, When and Where — Early Days of Herpetology in the Midwest"; Tom Weidner, "Looking Back, Looking Ahead — A Lifetime of Keeping Boas and Pythons"; Dr. Bernard Bechtel, "Abnormal Snakes"; Professor Daryl Karns, "Ecology of Homalopsine Snakes in Malaysia and Thailand" and Jim Harrison, "Radiotelemetry Field Studies in Brazil."

Full registration for the conference is \$48 until September 1, \$63 thereafter. The optional banquet is an additional \$23.50 per person. Vendor fees are \$10 for Friday night only or \$30 for the entire weekend. In addition vendors are expected to make a donation to the auction. For registration materials, contact Holly Carter, Hoosier Herpetological Society Secretary, 625 Lakeview Drive, Zionsville IN 46077, (317) 873-6561.

THE ADVENTURES OF SPOT



NONPROFIT ORG.
U.S. POSTAGE
PAID
PERMIT NO. 9869
CHICAGO, ILLINOIS

CHICAGO HERPETOLOGICAL SOCIETY
Affiliated with the Chicago Academy of Sciences

2060 North Clark Street • Chicago, Illinois 60614